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APRIL 2007

NATIONAL GEOGRAPHIC

SPECIAL REPORT

Saving the Sea's Bounty

**The Majestic Bluefin
Safe Haven in New Zealand
Village of Empty Nets**

Hip-Hop Planet 100 Tallgrass Prairie 120 Leopard Lessons 142

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Digital photo just got a big he



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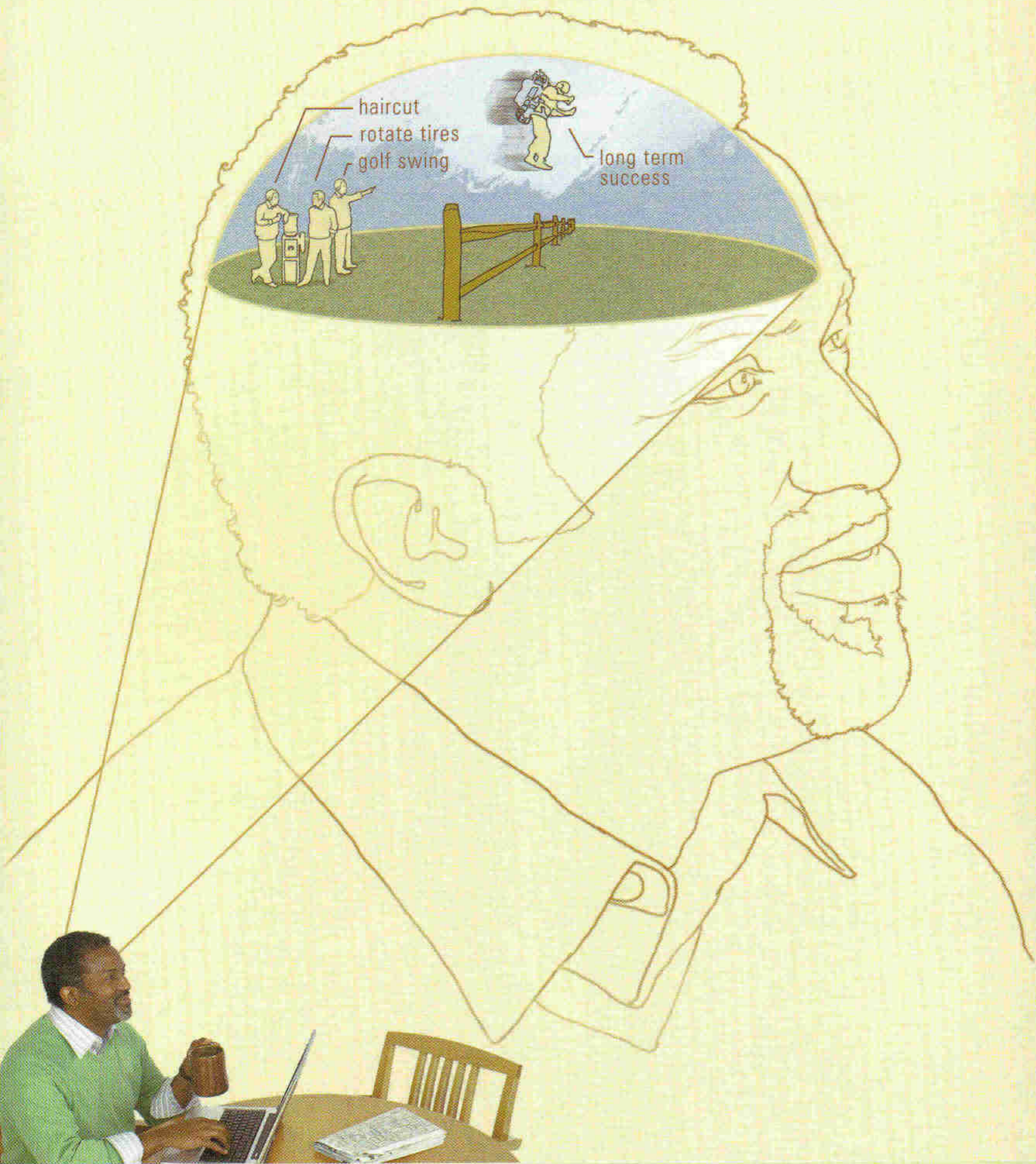


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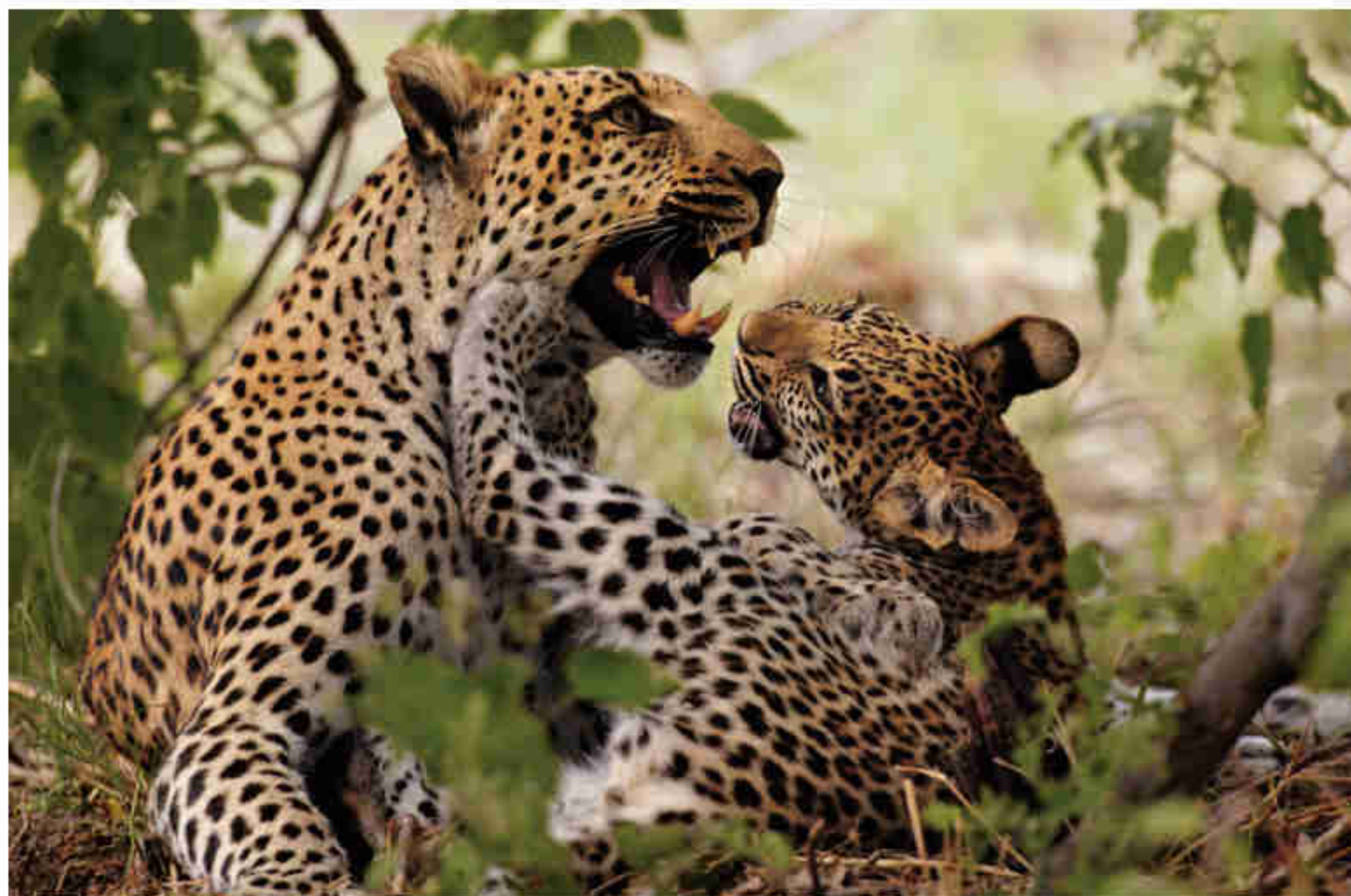
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NATIONAL GEOGRAPHIC

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A leopard roughhouses with her five-month-old cub in Botswana's Okavango Delta. Story on page 142.



BEVERLY JOUBERT

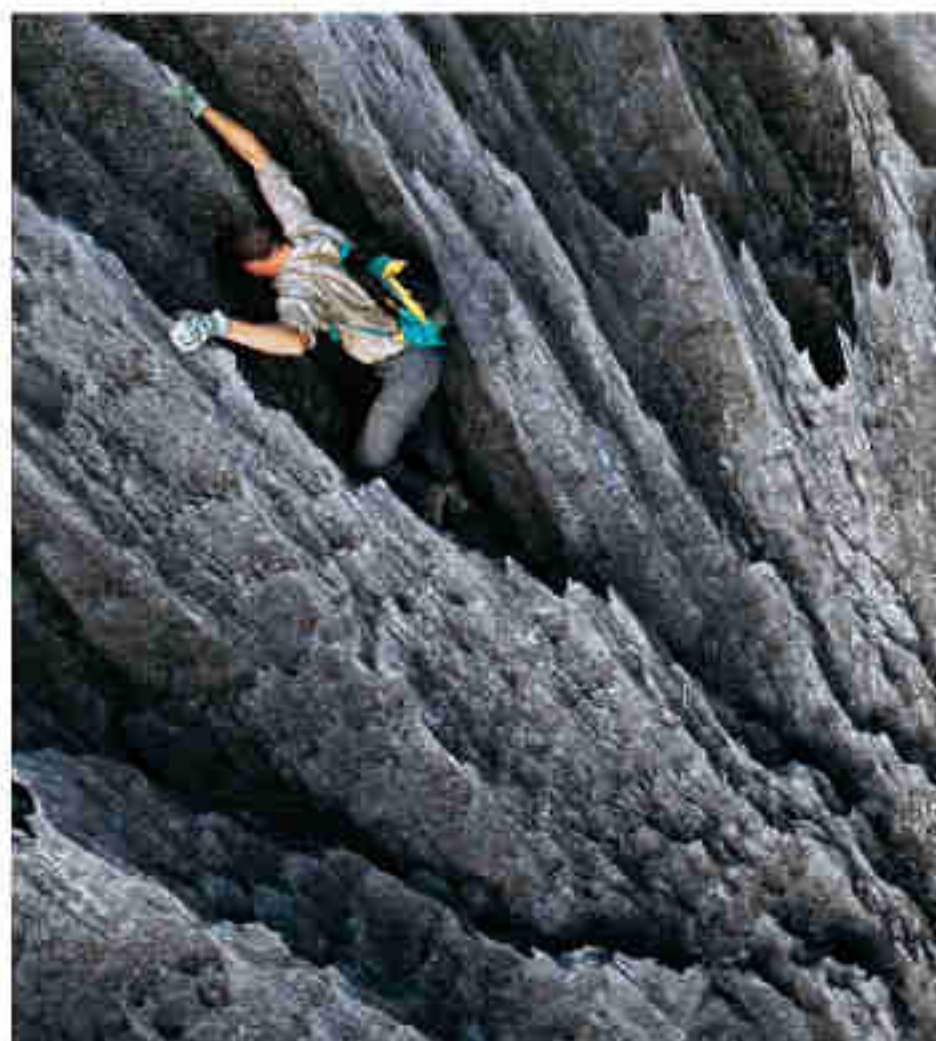
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BY DERECK JOUBERT PHOTOGRAPHS BY BEVERLY JOUBERT

COVER A young swordfish is fatally caught in a net intended for tuna.
PHOTO BY BRIAN SKERRY

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Madagascar



Lost Culture



Flamingo Deaths

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↗ Global Fisheries

Help depleted fisheries bounce back. Find practical tips about which fish to seek out at restaurants and grocery stores and which to avoid.

↗ Leopard Lessons

Follow a mother leopard and her cub as the cub learns to survive on its own in this video by Dereck and Beverly Joubert.

↗ Hip-Hop

In this multimedia presentation, trace hip-hop's path from West Africa to New York City. Hear from Uptown, an aspiring rapper from the Bronx River Houses.

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Salmon jump the falls in Alaska's Katmai National Park and Preserve.

A friend tells me that bluefin tuna are the most beautiful swimmers in the world, but I can't imagine anything more lovely than salmon. I remember seeing them swimming up British Columbia's Lillooet River, bright as silver coins and sleek as torpedoes. They swam powerfully, bodies glistening in midair as they leaped over rocks. The salmon had traveled more than 200 miles from the Pacific to their upstream birthplace. It was as breathtaking as watching a wildebeest herd move across the Serengeti Plain.

That Serengeti migration is healthy, but many fish migrations are not. Perhaps it's because the wildebeest travel in full view and are often photographed. Fish migrate largely out of sight.

Imagine huge machines from nations far from Tanzania arriving uninvited in the Serengeti, killing every wildebeest in sight. Most other animals and plants in the habitat would be destroyed as well. Such a reckless harvest would force people who had hunted there for generations to move or starve.

This scenario seems far-fetched until we consider the global fishing industry, which operates with such large-scale efficiency that fish stocks are being depleted at unprecedented rates. Fortunately, New Zealanders are doing something about the problem. They've shown that fishery management works. By learning from their success, we can ensure that the beautiful swimmers of the world continue to provoke awe in those privileged to see them.

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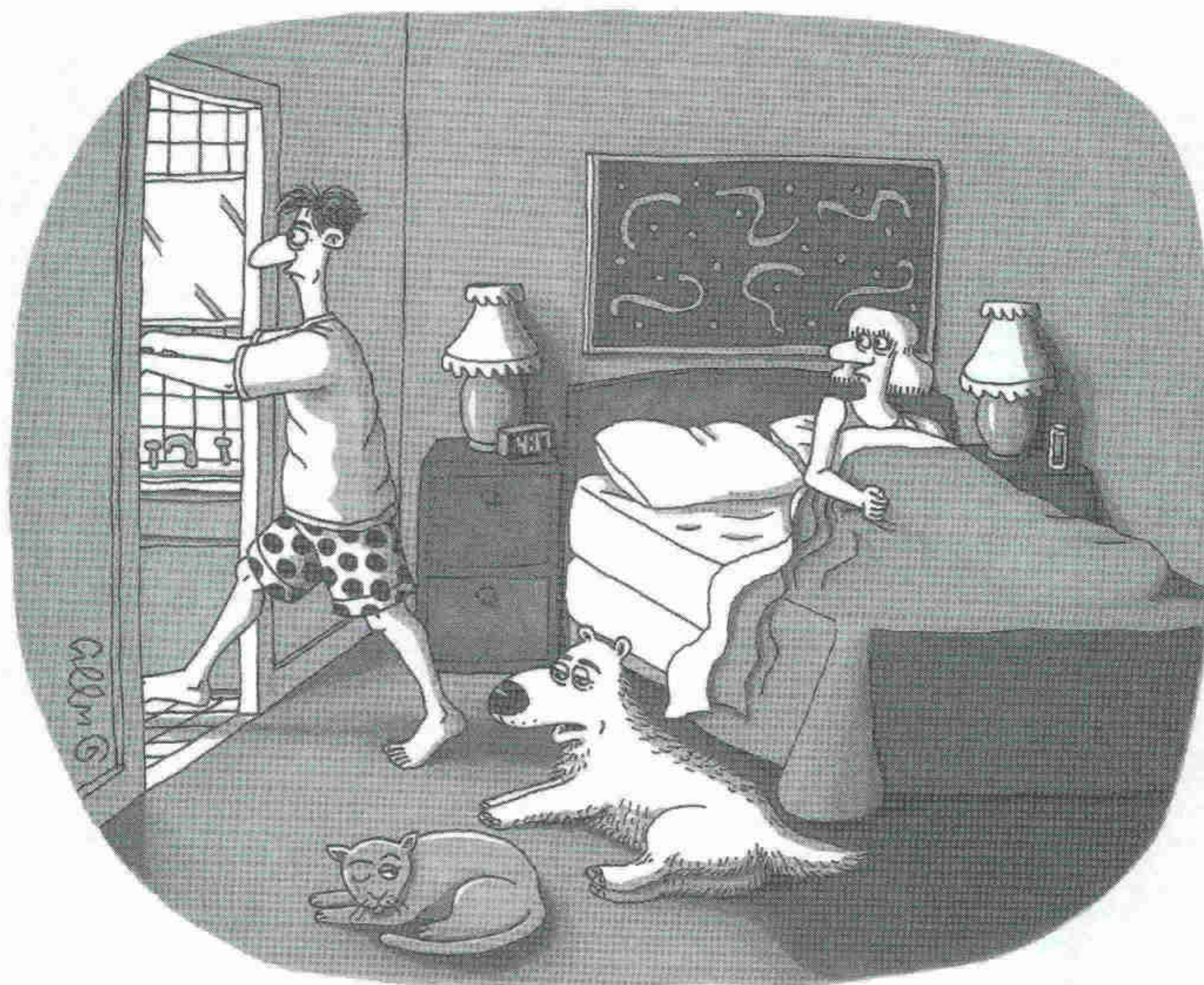
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*“He goes three times a night.
He must really need to mark his territory.”*

*You probably think you have a going problem. Instead, it might be a **growing** problem.*

If you not only have to go to the bathroom often, but find it's hard to start once you get there. Or see that you're starting and stopping, you may have an enlarging prostate. And you don't have to put up with it. Ask your doctor if *Avodart* is right for you. Most medicines only treat urinary symptoms. *Avodart*, with time, actually shrinks the prostate and reduces symptoms. So you can spend less time in the bathroom and more time in bed.

Important Safety Information About Prescription AVODART® (dutasteride): *Avodart* is used to treat urinary symptoms of Enlarging Prostate. Only your doctor can tell if your symptoms are from an enlarged prostate and not a more serious condition, such as prostate cancer. See your doctor for regular exams. Women and children should not take *Avodart*. Women who are or could become pregnant should not handle *Avodart* due to the potential risk of a specific birth

AVODART®
(dutasteride)
Soft Gelatin Capsules 0.5 mg
FOR YOUR GROWING PROBLEM

defect. Do not donate blood until at least six months after stopping *Avodart*. Tell your doctor if you have liver disease. *Avodart* may not be right for you. Possible side effects, including sexual side effects and swelling or tenderness of the breast, occur infrequently. **See important information on next page.**

Do you have an enlarging prostate?

If you have any of these urinary symptoms, talk to your doctor.

- Urination starts and stops.
- Frequent urge to urinate.
- Difficulty emptying your bladder.
- Symptoms get in the way of your life.
- Getting up to urinate 2 or more times a night.



GlaxoSmithKline

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Patient Information

AVODART® (dutasteride) Soft Gelatin Capsules

AVODART is for use by men only.

Read this information carefully before you start taking AVODART. Read the information you get with AVODART each time you refill your prescription. There may be new information. This information does not take the place of talking with your doctor.

0.5 mg/Once Daily

AVODART[®]
(dutasteride)

What is AVODART?

AVODART is a medication for the treatment of symptoms of benign prostatic hyperplasia (BPH) in men with an enlarged prostate to:

- Improve symptoms
- Reduce the risk of acute urinary retention (a complete blockage of urine flow)
- Reduce the risk of the need for BPH-related surgery

AVODART is not a treatment for prostate cancer. See the end of this leaflet for information about how AVODART works.

Who should NOT take AVODART?

- Women and children should not take AVODART. A woman who is pregnant or capable of becoming pregnant should not handle AVODART capsules. See "What are the special warnings for women about AVODART?"
- Do not take AVODART if you have had an allergic reaction to AVODART or any of its ingredients.

What are the special warnings for women about AVODART?

- Women should never take AVODART.
- Women who are pregnant or may become pregnant should not handle AVODART Capsules. If a woman who is pregnant with a male baby gets enough AVODART into her body after swallowing it or through her skin after handling it, the male baby may be born with abnormal sex organs.

What are the special precautions about AVODART?

- Men treated with AVODART should not donate blood until at least 6 months after their final dose to prevent giving AVODART to a pregnant female through a blood transfusion.
- Tell your doctor if you have liver problems. AVODART may not be right for you.

How should I take AVODART?

- Take 1 AVODART capsule once a day.
- Swallow the capsule whole.
- You can take AVODART with or without food.
- If you miss a dose, you may take it later that day. Do not make up the missed dose by taking 2 doses the next day.
- You may find it helpful to take AVODART at the same time every day to help you remember to take your dose.

What are the possible side effects of AVODART?

Possible side effects are impotence (trouble getting or keeping an erection), a decrease in libido (sex drive), enlarged breasts, a decrease in the amount of semen released during sex, and allergic reactions such as rash, itching, hives, and swelling of the lips or face. These events occurred infrequently.

Talk with your doctor if you have questions about these and other side effects that you think may be related to taking AVODART.

How should I store AVODART?

AVODART is a soft gelatin capsule that may become soft and leak or may stick to other capsules if kept at high temperatures. Store AVODART capsules at room temperature of 77°F (25°C) or lower.

If your capsules are cracked or leaking, don't use them, and contact your pharmacist.

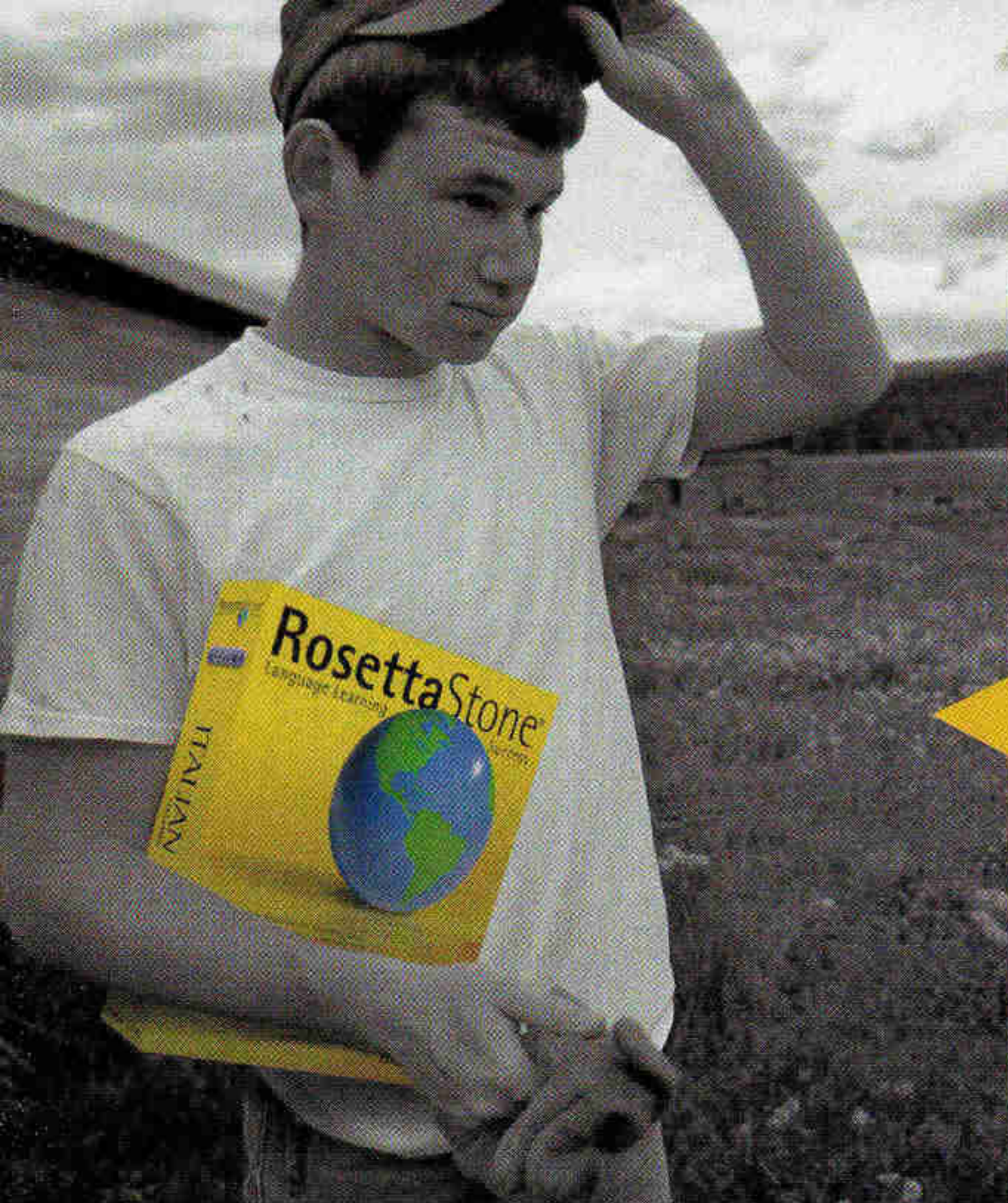
General information about AVODART.

- Do not use AVODART for a condition for which it was not prescribed.
 - Do not share your AVODART.
 - Ask your doctor about how often you should return for a visit to check your BPH.
 - A blood test called PSA (prostate-specific antigen) is sometimes used to detect prostate cancer. AVODART will reduce the amount of PSA measured in your blood. Your doctor is aware of this effect and can still use PSA to detect prostate cancer in you.
- If you have questions about AVODART, ask your doctor or pharmacist. They can show you detailed information about AVODART that was written for healthcare professionals.

How does AVODART work?

Prostate growth is caused by a hormone in the blood called dihydrotestosterone (DHT). AVODART lowers DHT production in the body, leading to shrinkage of the enlarged prostate in most men. Just as your prostate became large over a long period of time, reducing the size of your prostate and improving your symptoms will take time. While some men have fewer problems and symptoms after 3 months of treatment with AVODART, a treatment period of at least 6 months is usually necessary to see if AVODART will work for you. Studies have shown that treatment with AVODART for 2 years reduces the risk of complete blockage of urine flow (acute urinary retention) and/or the need for surgery for benign prostatic hyperplasia.





He was a hardworking farm boy.

She was an Italian supermodel.


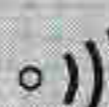


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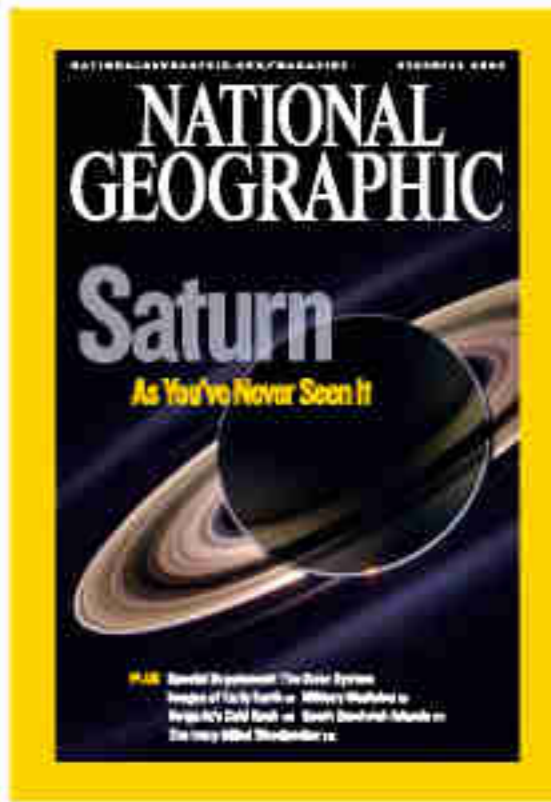


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December 2006 *“The Heroes, the Healing”* generated the most mail this month. *Gayle Chappell* wrote about her niece, who served in a Baghdad ambulance unit and whose new husband was also in Iraq: *“Until I saw your pictures, I had no idea what they each faced.”* Reader *Axel Stein* noted: *“Saturn (your cover) and Iraq seemed equally distant. Until today.”*

➤ Voice opinions on April stories at ngm.com.

Military Medicine

I was stationed at Balad Air Base when your photographer came through. I’m a surgical technician, and he was taking pictures of one of the most devastating and stressful surgeries I’ve ever been a part of. I worked for well over eight hours that day, only stopping because I was being relieved by the next shift. Obviously I was too busy to meet your photographer or speak with

him (or even to catch his name), and at the time I actually found him a bit of a nuisance because it was hard to accept that people could come in and take pictures of a life slipping through our fingers. Now I realize that this capture of emotion, life, and death is pivotal to the general understanding of the reality of war, and I commend that.

MICHAELA SCHILTZ
Madison, Wisconsin

As a physician and U.S. Army Iraq veteran, I was incredibly moved by “The Heroes, the Healing.” Returning home to a fragmented health system, not to mention patients who think that a runny nose is a life-threatening emergency, has made me really value the opportunity I had to care for American soldiers and Iraqi civilians while deployed. I keep my Combat Medic badge in my pocket when I am in clinic these days to remind me that I was a small part of world history and that I had the privilege to care for American heroes.

TODD FREDRICKS
Amesville, Ohio

Thank you so much for the beautiful photos and article on the military medical staff in

Iraq. No doubt many people will write to say you should not have published those pictures of wounded soldiers, but I think they were a very restrained view of what our troops are going through. People should know the miracles that those doctors, nurses, and medics are performing daily. I was especially fascinated to see the new discoveries about traumatic brain injury. It makes me wonder how many cases of shell shock, battle fatigue, and post-traumatic stress disorder are really undiagnosed closed-brain injuries. Perhaps the PTSD-diagnosed Vietnam veterans should be screened for traumatic brain injury as well as the returning Iraq veterans.

SUSAN BUCKNER
Seal Beach, California

My father-in-law, a WWII vet, read the article, shaking his head. Upon finishing he said, "Every congressman needs to read that article." I second that opinion and add: every schoolchild, father, mother, sister, and brother.

STEPHEN BURT
Portland, Maine

Your December article about military medicine awoke deeply hidden memories. I now remember, as a little girl in the 1960s, my grandfather sitting in his chair with a thousand-mile stare, rubbing a faceless medal of the Virgin Mary. Years later I learned that in 1917, he had taken part in the capture of Vimy Ridge. He never said a word about it.

CHRISTINE GAUTHIER-DAUPHIN
Sherbrooke, Quebec

I began flicking backward through the photographs of wounded soldiers in Iraq and was humbled by the sacrifice portrayed. Finally, I turned the page to see the photograph of a whisk fern poking through one of Hawaii's recently cooled lava flows. It left me looking forward to the day that life can spring so freely from the trauma of Iraq.

NICHOLAS SALMON
Walton, England

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Saturn: Beautiful Stranger

The coolest thing about the cover of Saturn is that "the faint dot at left, just outside the brightest ring, is Earth." Gives us Earthlings a true feeling of how miraculous our planet is in the immensity of the universe. We need to tend it with much more respect and care.

CAROLYN O'MALLEY
Bedford, Texas

I showed the photos taken by Cassini to my class of fifth graders, and I reminded them that the spacecraft was sent at about the same time they were born. After I mentioned that Saturn has 56 moons, one of my students commented, "Nights on Saturn must be pretty bright with all that reflected light." With dozens of moons, could this be so?

SCOTT LEE
St. George, Utah

Saturn's moons are so small, especially compared with the size of the planet, that nights there have negligible moonlight.

Corrections, Clarifications

November 2006:

Murdering the Impossible

We regret misspelling the names of Peter Scholz and Willy Merkl. Reinhold Messner was 23 when his essay "The Murder of the Impossible" was first published in German. The photo on page 54 should have been credited to Alessandro Gogna, K3 Photo Agency.

December 2006:

The Ghost Bird The website note credited Nancy Tanner with the last confirmed sighting of the ivory-billed woodpecker. Tanner was one of the last people to glimpse the bird, but the final confirmed U.S. sighting was made in 1944 by Don Eckelberry.

Solar System Map

The solar system supplement is top-notch. But honestly: eight planets? I should have thought that NATIONAL GEOGRAPHIC of all publications would not be giving credence to a group of history-hungry people who hope to make their career by "demoting" the planet Pluto. These are the same type of people who've been trying to convince me that Europe and Asia are separate continents. If they should ever succeed in correcting this more obvious mistake, then I shall be happy to start calling Pluto a planetoid. Until then, Pluto is a planet!

LEE JEFFREYS
Springfield, Missouri

The Ghost Bird

I was one of those many people who were ecstatic over the wonderful news of the rediscovery of the ivory-billed woodpecker. I saw it as proof that our conservation efforts were having an effect. As I read the article, I had to ask myself why Mel White found the need to burst people's bubble. We many had found the joy, it hurt no one, and it gave us hope. Then I tried to do some Sherlock Holmes type of thinking. I concluded that White indeed is a true believer in the existence of an ivory-billed woodpecker. He only wrote his bubble-bursting article to protect the beautiful bird! My faith is restored, and my belief in the woodpecker's existence further proven. Good job, "Mr. White," if that is indeed your real name.

MICHAEL THOMAS
Richmond, California



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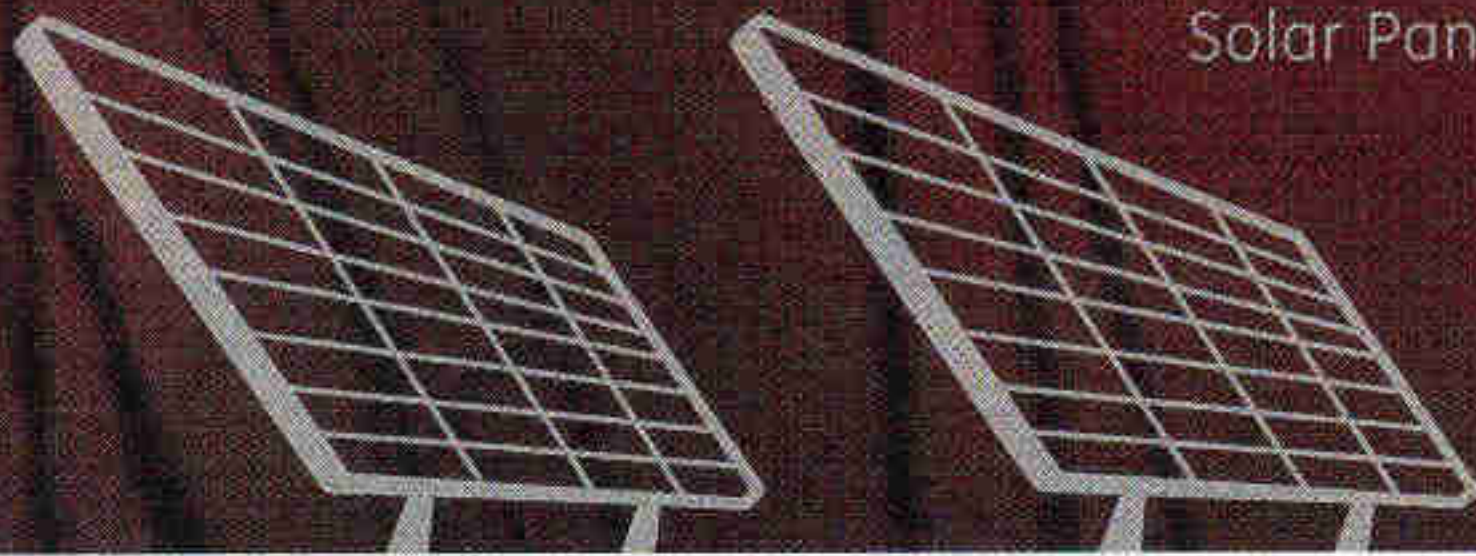
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Animal, Vegetable, Minimal Simple compositions featuring an extravagantly frilled cabbage and some itchy bears caught the eyes of the Your Shot editors this month. Send in your own picture for possible publication in NATIONAL GEOGRAPHIC. For guidelines, a submission form, and more information, go to ngm.com/yourshot.

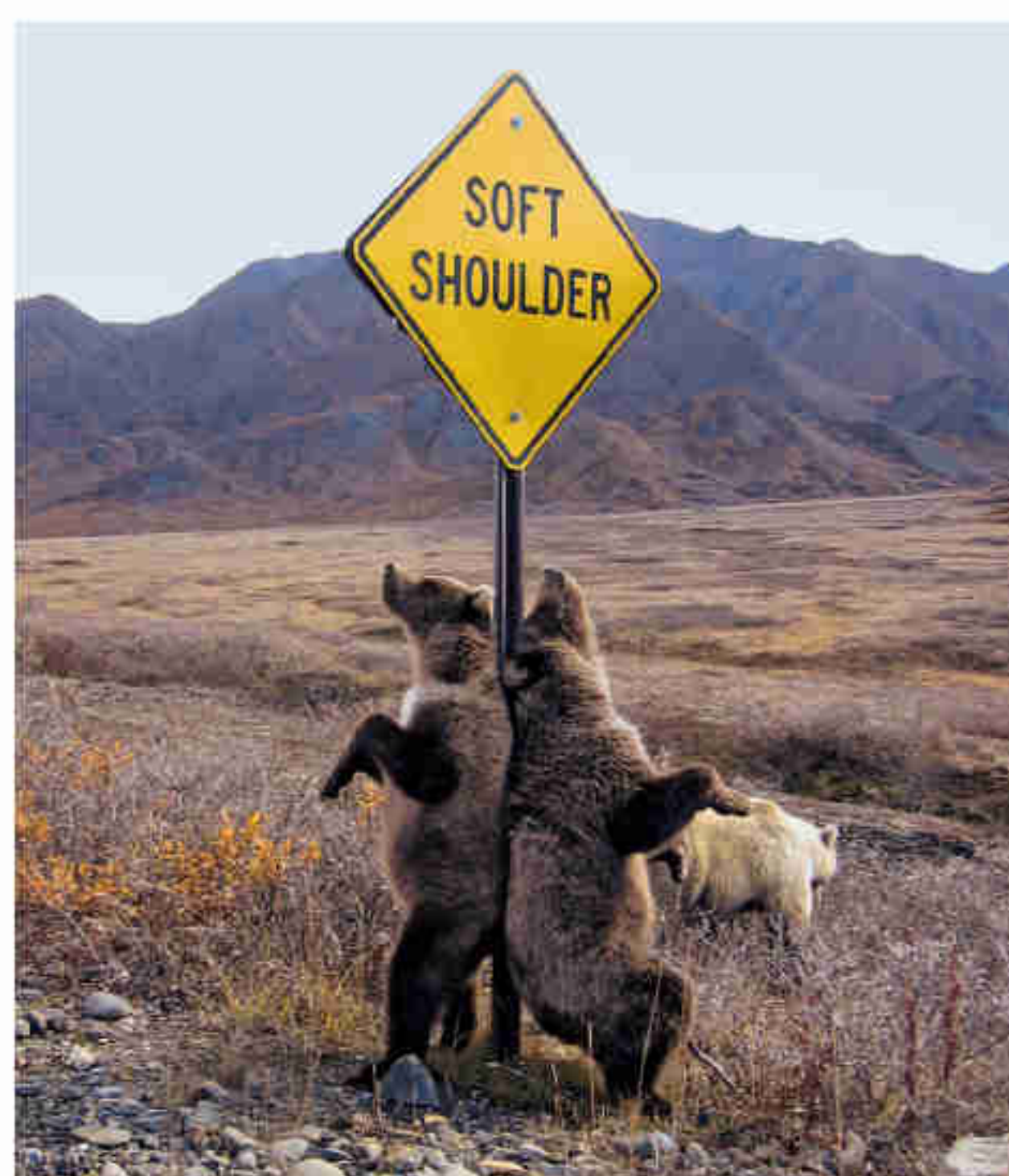


Luis Zilhão Figueira da Foz, Portugal

Luis Zilhão captured this rush-hour scene in the Portuguese village of Vilarinho Seco. "When everybody is going home after a day in the field, you see people guiding animals and carrying vegetables or wood for the fireside where dinner will be cooked in old metal cauldrons."

Mark Dilley Salem, South Dakota

Two young grizzlies took a road sign literally in Alaska's Denali National Park. Photographer Mark Dilley—shooting from the safety of his car—had glimpsed a bear scratching itself on the same sign years earlier. "I didn't think I'd get another chance to get that shot," he says.



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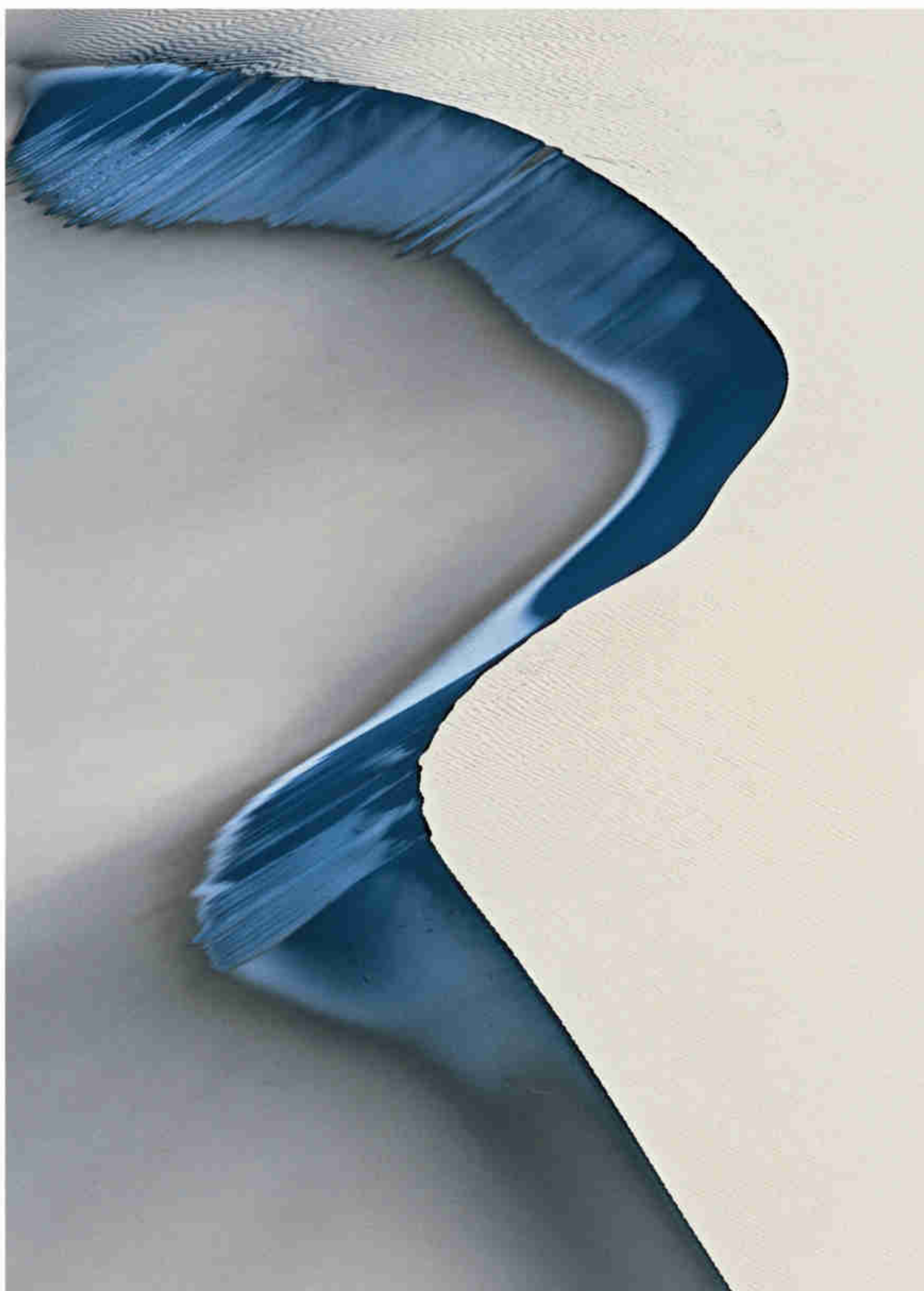
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Photographer John B. Weller's first book is *Great Sand Dunes National Park: Between Light and Shadow*.

Dunes The beginning was a meteor shower. In the black night of Colorado's Great Sand Dunes National Park, through the lung-aching cold, I watched shooting stars arc through the dark as I drifted toward sleep. The wind-ridged dune under my sleeping bag felt like a giant's thumbprint. Waking to dawn, I saw mountains of sand—the tallest dunes in North America—turned white with frost. Sunrise soon washed the ice coating from east-facing slopes, but in sinuous shadows, the glassy frost remained (above) to mirror an electric blue sky.

A week out of every month for the next three and a half years, I returned to this park to make pictures. Each trip helped me learn the connection between my own footprints and the wind's brutal, delicate sculpture of sand. Once I sat under a tall pine for two days, waiting for hummingbirds, and in the vast silence the sound of my camera shutter cracked like thunder.

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- See the Northern Lights
- Take a train ride on the Orient Express
- Go to the Galapagos Islands
- Ride a motorcycle across the U.S.
- Help dig for dinosaur bones
- Float along the Nile
- Own a set of Frette linens
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- Climb Mount Olympus
- Watch the Sumo Wrestling Championship in Japan
- Ride a mule through the Grand Canyon
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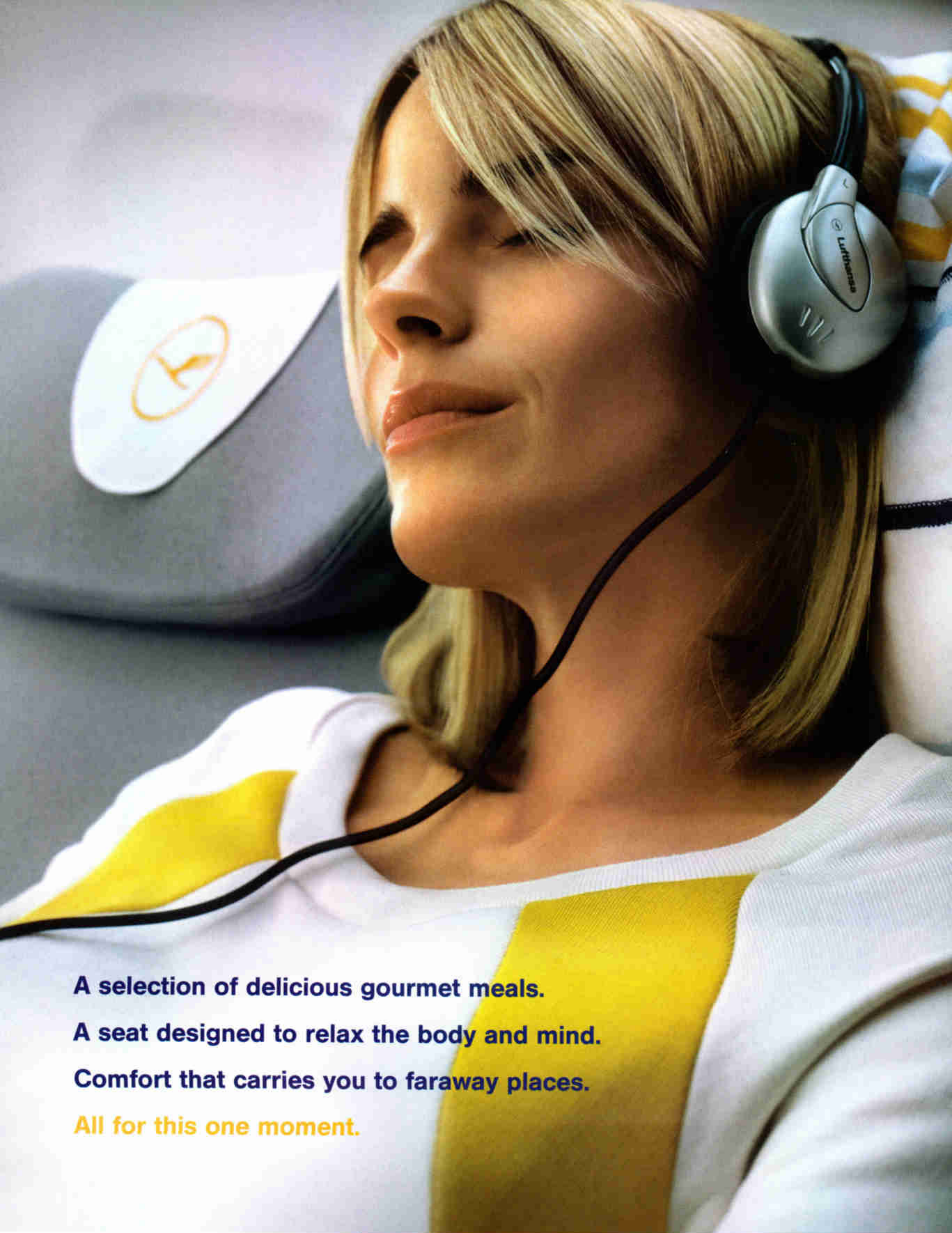


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A storm sweeps down the San Luis Valley to coat the sands with fresh snow (above). The park's dunes are actually quite stable; historical photographs show that most have not moved significantly in more than a century. A complex mosaic of sand plants (below) anchors the ecosystem, absorbing even the heaviest rain within hours.





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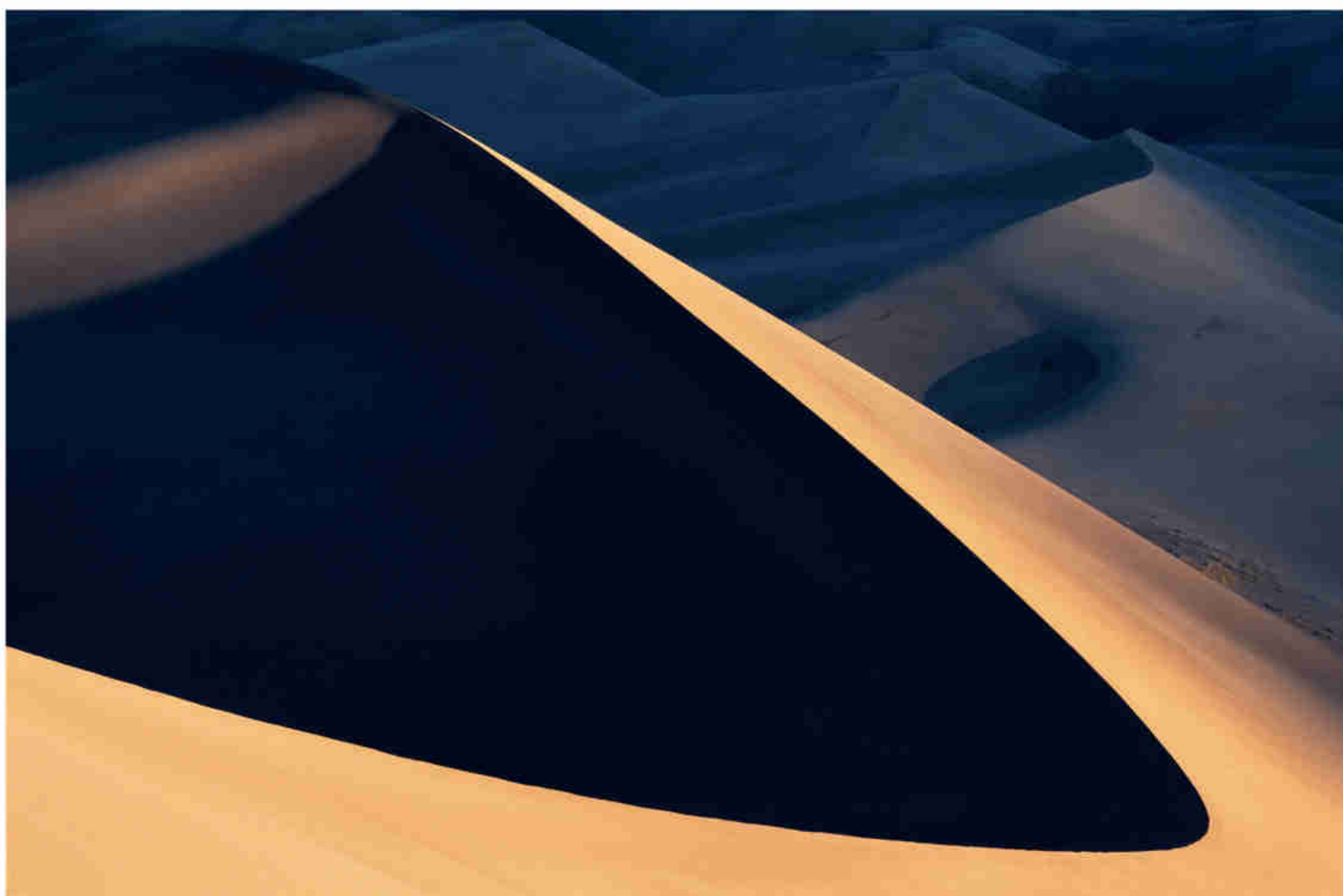
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Winds roaring in from a valley and two mountain passes shaped the three faces of Star Dune (above), seen here at sunrise. Extreme landscapes (below) endure extreme conditions: Winds have been clocked at 80 miles an hour in the park, summer sand temperatures have hit 140°F, winter air temperatures have plummeted to minus 25°F.



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IMPORTANT SAFETY INFORMATION: LUNESTA works quickly, and should be taken right before bed. Be sure you have at least eight hours to devote to sleep before becoming active. Until you know how you'll react to prescription LUNESTA, you should not drive or operate machinery. Do not use alcohol while taking LUNESTA. Most sleep medicines carry some risk of dependency. Side effects may include unpleasant taste, headache, drowsiness and dizziness. See important patient information on the next page.



Please read this summary of information about LUNESTA before you talk to your doctor or start using LUNESTA. It is not meant to take the place of your doctor's instructions. If you have any questions about LUNESTA tablets, be sure to ask your doctor or pharmacist.

LUNESTA is used to treat different types of sleep problems, such as difficulty in falling asleep, difficulty in maintaining sleep during the night, and waking up too early in the morning. Most people with insomnia have more than one of these problems. You should take LUNESTA immediately before going to bed because of the risk of falling.

LUNESTA belongs to a group of medicines known as "hypnotics" or, simply, sleep medicines. There are many different sleep medicines available to help people sleep better. Insomnia is often transient and intermittent. It usually requires treatment for only a short time, usually 7 to 10 days up to 2 weeks. If your insomnia does not improve after 7 to 10 days of treatment, see your doctor, because it may be a sign of an underlying condition. Some people have chronic sleep problems that may require more prolonged use of sleep medicine. However, you should not use these medicines for long periods without talking with your doctor about the risks and benefits of prolonged use.

Side Effects

All medicines have side effects. The most common side effects of sleep medicines are:

- Drowsiness
- Dizziness
- Lightheadedness
- Difficulty with coordination

Sleep medicines can make you sleepy during the day. How drowsy you feel depends upon how your body reacts to the medicine, which sleep medicine you are taking, and how large a dose your doctor has prescribed. Daytime drowsiness is best avoided by taking the lowest dose possible that will still help you sleep at night. Your doctor will work with you to find the dose of LUNESTA that is best for you. Some people taking LUNESTA have reported next-day sleepiness.

To manage these side effects while you are taking this medicine:

- When you first start taking LUNESTA or any other sleep medicine, until you know whether the medicine will still have some effect on you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
- Do not drink alcohol when you are taking LUNESTA or any sleep medicine. Alcohol can increase the side effects of LUNESTA or any other sleep medicine.
- Do not take any other medicines without asking your doctor first. This includes medicines you can buy without a prescription. Some medicines can cause drowsiness and are best avoided while taking LUNESTA.
- Always take the exact dose of LUNESTA prescribed by your doctor. Never change your dose without talking to your doctor first.

Special Concerns

There are some special problems that may occur while taking sleep medicines.

Memory Problems

Sleep medicines may cause a special type of memory loss or "amnesia." When this occurs, a person may not remember what has happened for several hours after taking the medicine. This is usually not a problem since most people fall asleep after taking the medicine. Memory loss can be a problem, however, when sleep medicines are taken while traveling, such as during an airplane flight and the person wakes up before the effect of the medicine is gone. This has been called "traveler's amnesia." Memory problems have been reported rarely by patients taking LUNESTA in clinical studies. In most cases, memory problems can be avoided if you take LUNESTA only when you are able to

get a full night of sleep before you need to be active again. Be sure to talk to your doctor if you think you are having memory problems.

Tolerance

When sleep medicines are used every night for more than a few weeks, they may lose their effectiveness in helping you sleep. This is known as "tolerance." Development of tolerance to LUNESTA was not observed in a clinical study of 6 months' duration. Insomnia is often transient and intermittent, and prolonged use of sleep medicines is generally not necessary. Some people, though, have chronic sleep problems that may require more prolonged use of sleep medicine. If your sleep problems continue, consult your doctor, who will determine whether other measures are needed to overcome your sleep problems.

Dependence

Sleep medicines can cause dependence in some people, especially when these medicines are used regularly for longer than a few weeks or at high doses. Dependence is the need to continue taking a medicine because stopping it is unpleasant. When people develop dependence, stopping the medicine suddenly may cause unpleasant symptoms (see *Withdrawal* below). They may find they have to keep taking the medicine either at the prescribed dose or at increasing doses just to avoid withdrawal symptoms.

All people taking sleep medicines have some risk of becoming dependent on the medicine. However, people who have been dependent on alcohol or other drugs in the past may have a higher chance of becoming addicted to sleep medicines. This possibility must be considered before using these medicines for more than a few weeks. If you have been addicted to alcohol or drugs in the past, it is important to tell your doctor before starting LUNESTA or any sleep medicine.

Withdrawal

Withdrawal symptoms may occur when sleep medicines are stopped suddenly after being used daily for a long time. In some cases, these symptoms can occur even if the medicine has been used for only a week or two. In mild cases, withdrawal symptoms may include unpleasant feelings. In more severe cases, abdominal and muscle cramps, vomiting, sweating, shakiness, and, rarely, seizures may occur. These more severe withdrawal symptoms are very uncommon. Although withdrawal symptoms have not been observed in the relatively limited controlled trials experience with LUNESTA, there is, nevertheless, the risk of such events in association with the use of any sleep medicine.

Another problem that may occur when sleep medicines are stopped is known as "rebound insomnia." This means that a person may have more trouble sleeping the first few nights after the medicine is stopped than before starting the medicine. If you should experience rebound insomnia, do not get discouraged. This problem usually goes away on its own after 1 or 2 nights.

If you have been taking LUNESTA or any other sleep medicine for more than 1 or 2 weeks, do not stop taking it on your own. Always follow your doctor's directions.

Changes In Behavior And Thinking

Some people using sleep medicines have experienced unusual changes in their thinking and/or behavior. These effects are not common. However, they have included:

- More outgoing or aggressive behavior than normal
- Confusion
- Strange behavior
- Agitation
- Hallucinations
- Worsening of depression
- Suicidal thoughts

How often these effects occur depends on several factors, such as a person's general health, the use of other medicines, and which sleep medicine is being used. Clinical experience with LUNESTA suggests that it is rarely associated with these behavior changes.

It is also important to realize it is rarely clear whether these behavior changes are caused by the medicine, are caused by an illness, or have occurred on their own. In fact, sleep problems that do not

improve may be due to illnesses that were present before the medicine was used. If you or your family notice any changes in your behavior, or if you have any unusual or disturbing thoughts, call your doctor immediately.

Pregnancy And Breastfeeding

Sleep medicines may cause sedation or other potential effects in the unborn baby when used during the last weeks of pregnancy. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking LUNESTA.

In addition, a very small amount of LUNESTA may be present in breast milk after use of the medication. The effects of very small amounts of LUNESTA on an infant are not known; therefore, as with all other prescription sleep medicines, it is recommended that you not take LUNESTA if you are breastfeeding a baby.

Safe Use Of Sleep Medicines

To ensure the safe and effective use of LUNESTA or any other sleep medicine, you should observe the following cautions:

1. LUNESTA is a prescription medicine and should be used ONLY as directed by your doctor. Follow your doctor's instructions about how to take, when to take, and how long to take LUNESTA.
2. Never use LUNESTA or any other sleep medicine for longer than directed by your doctor.
3. If you notice any unusual and/or disturbing thoughts or behavior during treatment with LUNESTA or any other sleep medicine, contact your doctor.
4. Tell your doctor about any medicines you may be taking, including medicines you may buy without a prescription and herbal preparations. You should also tell your doctor if you drink alcohol. DO NOT use alcohol while taking LUNESTA or any other sleep medicine.
5. Do not take LUNESTA unless you are able to get 8 or more hours of sleep before you must be active again.
6. Do not increase the prescribed dose of LUNESTA or any other sleep medicine unless instructed by your doctor.
7. When you first start taking LUNESTA or any other sleep medicine, until you know whether the medicine will still have some effect on you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
8. Be aware that you may have more sleeping problems the first night or two after stopping any sleep medicine.
9. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, if you become pregnant, or if you are breastfeeding a baby while taking LUNESTA.
10. As with all prescription medicines, never share LUNESTA or any other sleep medicine with anyone else. Always store LUNESTA or any other sleep medicine in the original container and out of reach of children.
11. Be sure to tell your doctor if you suffer from depression.
12. LUNESTA works very quickly. You should only take LUNESTA immediately before going to bed.
13. For LUNESTA to work best, you should not take it with or immediately after a high-fat, heavy meal.
14. Some people, such as older adults (i.e., ages 65 and over) and people with liver disease, should start with the lower dose (1 mg) of LUNESTA. Your doctor may choose to start therapy at 2 mg. In general, adults under age 65 should be treated with 2 or 3 mg.
15. Each tablet is a single dose; do not crush or break the tablet.

Note: This summary provides important information about LUNESTA. If you would like more information, ask your doctor or pharmacist to let you read the Prescribing Information and then discuss it with him or her.

Rx only



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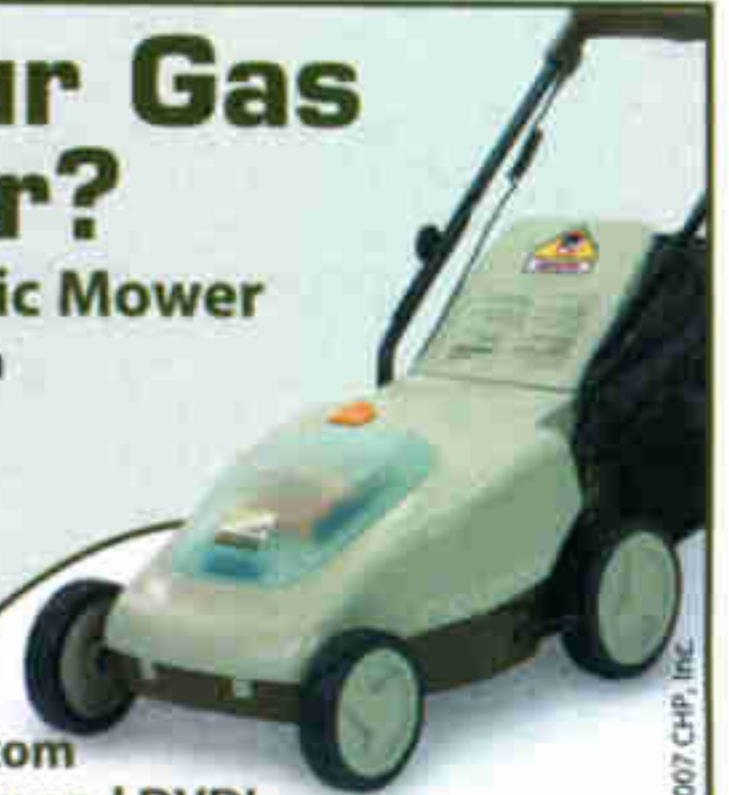
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San Francisco, California Seagulls wait for a miracle home-run shot: A player would have to knock the baseball 500 feet to reach this 32-foot-wide, 20,000-pound sculpture of a baseball glove standing atop the Giants' stadium.

PHOTO: MARCIO JOSÉ SÁNCHEZ, AP



Bemaraha National Park, Madagascar Rocks turned to razors, eroded limestone pinnacles rise 300-plus feet from the forest floor of this park—challenging researchers who study the island’s rare and endangered species.





Aachen, Germany Skidding from a full canter to a cloud-of-dust stop, horse and rider display a muscular flash of Old West skill at the 2006 World Equestrian Games. First prize in the individual reining competition: \$12,000.



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PHOTO: ROLF VENNENBERND, EPA/CORBIS



GEOGRAPHY



Intensity zones of a magnitude 7.7 quake

- Great damage to well-built structures, general panic
- Considerable damage to well-built structures, drivers have trouble steering
- Moderate to slight damage to well-built structures, people have difficulty standing

Recent earthquakes within the New Madrid seismic zone

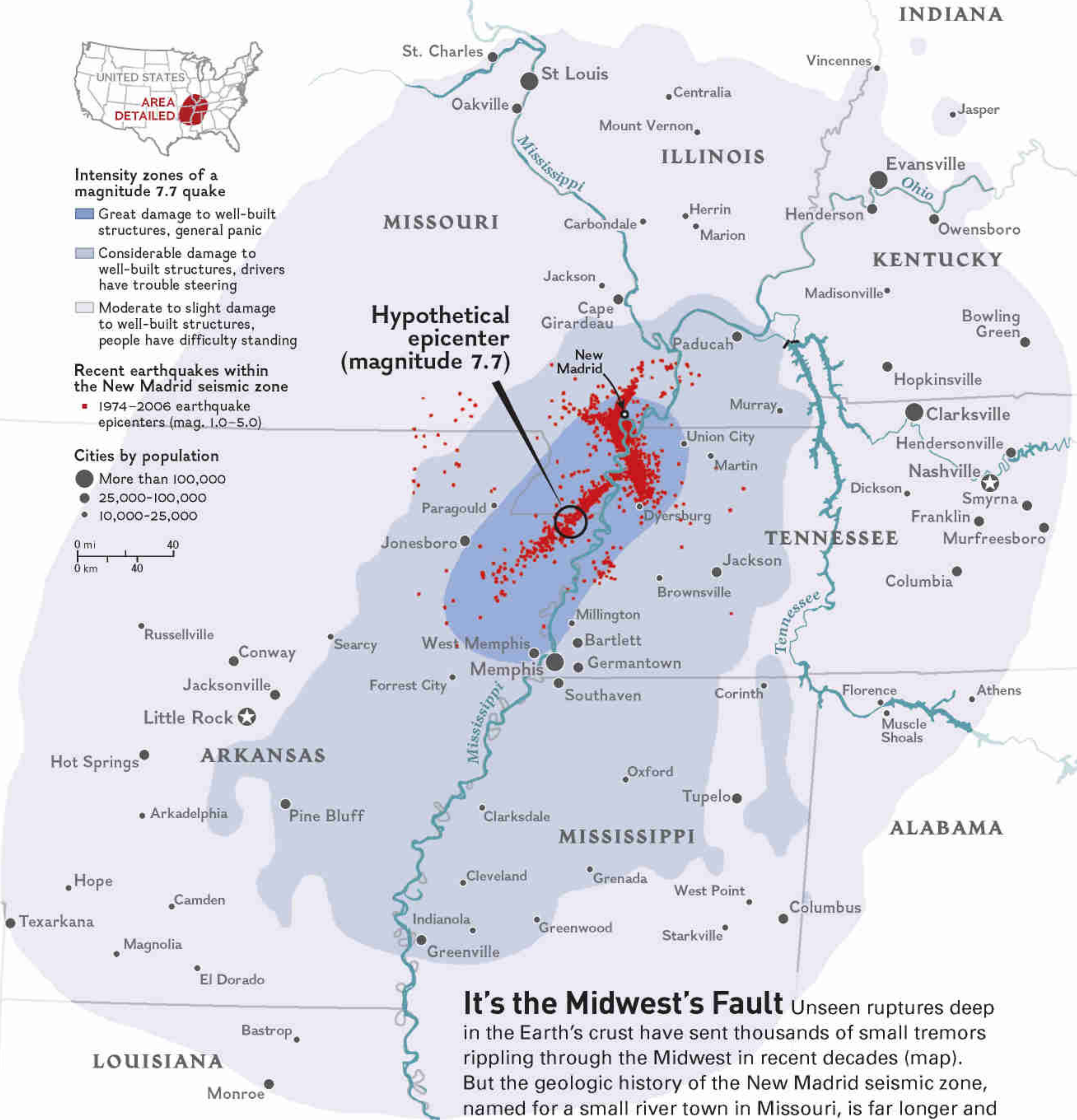
- 1974–2006 earthquake epicenters (mag. 1.0–5.0)

Cities by population

- More than 100,000
- 25,000–100,000
- 10,000–25,000



Hypothetical epicenter (magnitude 7.7)



The quakes of 1811 and 1812 created waterfalls on the usually calm Mississippi.

It's the Midwest's Fault

Unseen ruptures deep in the Earth's crust have sent thousands of small tremors rippling through the Midwest in recent decades (map). But the geologic history of the New Madrid seismic zone, named for a small river town in Missouri, is far longer and grimmer. A series of quakes here in 1811 and 1812 were perhaps the most vicious to hit North America since European settlement—destroying towns and opening fissures and sinkholes over thousands of square miles. Though the quakes were likely between magnitude 7.5 and 8, the area's tiny population meant few casualties. Today, with millions living nearby, the story would be different. Giant earthquakes hit the zone about every 500 years; geologists estimate a 10 percent chance of an event equal to the 19th-century quakes within 50 years. —Chris Carroll

ART: JAN KOZAK COLLECTION, UNIVERSITY OF CALIFORNIA, BERKELEY. SOURCES: CHRIS CRAMER, UNIVERSITY OF MEMPHIS; EUGENE SCHWEIG, U.S. GEOLOGICAL SURVEY. NGM MAPS





GREATEST HITS

- 1 You're So Van
- 2 Whole Lotta' Leather*
- 3 Takin' It to the Speed Limit
- 4 15 Cup-Holders of Love
- 5 Runnin' on All Six Cylinders
- 6 The Magic Third Row
- 7 We'll Get There Together (The Navi song)†
- 8 Honky Tonkin' Soccer Momma
- 9 Van of Fools
- 10 These Wheels Were Made for Errands
- 11 244 Wild Horses
- 12 I'd Like to Teach the World to Carpool

The funkadelic soul of the Odyssey is at its best in this original sheet-metal collection. Performance-heads will groove to a level of handling and power typically absent from releases in this genre. And there is no better embodiment of Honda's "Safety for Everyone" philosophy than this collection of active and passive safety features. Lifelong fans can rest assured there are many ties to Honda's earlier releases – signature reliability and exacting engineering are evident in each Odyssey performance. So, sit back and get into the groove of the Roadtrippin' experience.

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honda.com 1-800-33-Honda Touring model shown. *EX-L and Touring models only. †Honda Satellite-Linked Navigation System™ is available only in the 48 contiguous United States on EX-L models with DVD Entertainment System, and on Touring models. © 2006 American Honda Motor Co., Inc.



This flamingo died at Kenya's Lake Bogoria, a vital feeding site for the birds.



The Pink Plague The shores of Kenya's Lake Nakuru, famous for its mass gatherings of lesser flamingos, were scattered last summer with thousands of the birds' pale pink carcasses.

Occasional flamingo die-offs are natural, but unusually large events—which struck flamingos at several Rift Valley lakes during the 1990s—are being reported more often in this decade. Last summer an estimated 40,000 birds died at Nakuru; more than 15,000 perished at Tanzania's Lake Manyara in 2004. Possible causes being investigated by scientists include cyanobacterial toxins, avian cholera or tuberculosis, and man-made pollutants. Last fall, leading flamingo experts met in Nairobi to discuss ways to protect the birds, which are difficult to count because they fly between the lakes at night. Baz Hughes, head of species conservation for the U.K.'s Wildfowl and Wetlands Trust, is helping draft an action plan that could safeguard their habitats.

Even though there may be as many as 2.5 million lesser flamingos in East Africa, Hughes says the species is considered near threatened because "the birds are concentrated in a few feeding lakes and have only one regular breeding site in East Africa"—the hot, alkaline waters of Tanzania's otherworldly Lake Natron.

While researchers search for clues, conservationists want to reduce pollution at the lakes, protect the breeding site, and coordinate surveys of the lakes for more accurate counts of what may be a dwindling flamingo population. —Robert Koenig

7:56 a.m.

Floating on air...



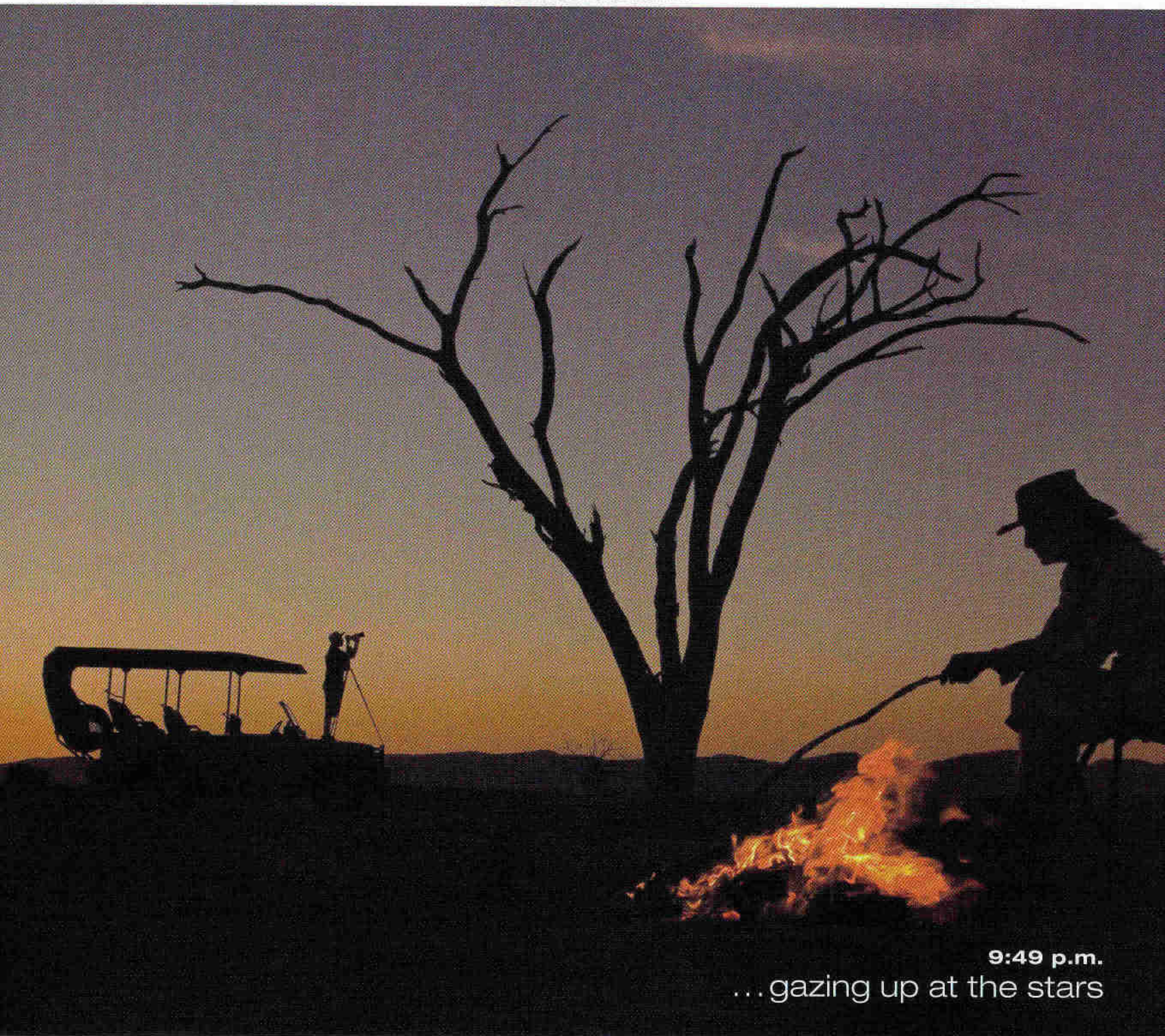
UNDER SOUTHERN AFRICAN SKIES...

Namibia - Soussevlei Driving out across the predawn desert, the sense of anticipation was palpable. The pilot and his team were preparing for take-off as we arrived, the bright flames inflating the balloon and igniting our imaginations. Finally we were off, rising silently into the sky, wondering at the incredible red sands stretching off to every horizon. Travelling at the same speed as the wind gave an illusion of stillness, but landing for a delicious champagne breakfast, it was revealed that we'd travelled miles across this amazing landscape. There is no better way to view the highest dunes in the world.

Later that evening, the Namib desert revealed another of its dazzling secrets. Slowly, one by one, then appearing in their millions, the stars of the heavens winked into view. Joined by the Southern Cross, every constellation in the sky was crystal clear. That night, sitting by the fire and gazing upwards, we truly got a sense of our place within the cosmos.



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9:49 p.m.
...gazing up at the stars

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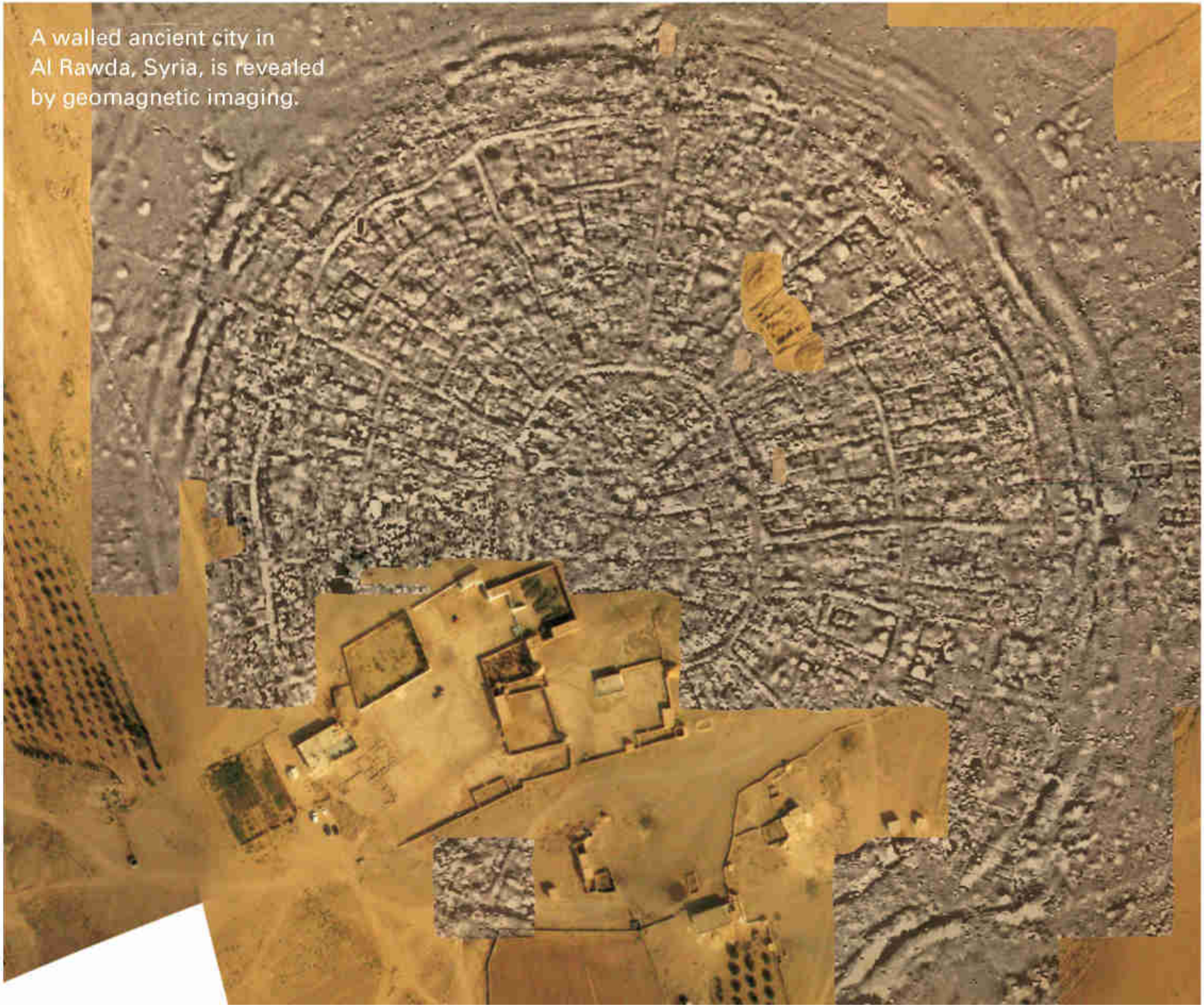
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TECHNOLOGY

A walled ancient city in Al Rawda, Syria, is revealed by geomagnetic imaging.



Aerial-photo overlay on a geomagnetic map

History's X-ray Buried under sand, the layout of a city some 4,000 years old has been revealed before anyone lifted a trowel. To build the map of Al Rawda (above), a third-millennium site in central Syria, archaeologists used geomagnetic imaging, which measures Earth's magnetic force. Al Rawda's flat topography and lack of modern buildings made it a perfect subject for the technology. The resulting map details an early planned city surrounded by defensive walls. Combined with traditional

excavation (visible in aerial photo), the image tells the story of a few thousand residents who worshipped at the city's religious complexes, traded with faraway cultures, grazed livestock, cultivated grapes and beans, and almost certainly paid taxes. —*Siobhan Roth*



Aerial photo





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Important Safety Information

AMBIEN is indicated for the short-term treatment of insomnia.

When you first start taking AMBIEN, use caution in the morning when engaging in activities requiring complete alertness until you know how you will react to this medication. In most instances, memory problems can be avoided if you take AMBIEN only when you are able to get a full night's sleep (7 to 8 hours) before you need to be active again. As with any sleep medication, do not use alcohol while you are taking AMBIEN.


Prescription sleep aids are often taken for 7 to 10 days — or longer as advised by your healthcare provider. Like most sleep medicines, it has some risk of dependency.

There is a low occurrence of side effects associated with the short-term use of AMBIEN. The most commonly observed side effects in controlled clinical trials were drowsiness (2%), dizziness (1%), and diarrhea (1%).

AMBIEN CR is indicated for treating insomnia.

It is a treatment option you and your healthcare provider can consider along with lifestyle changes and can be taken for as long as your healthcare provider recommends. Until you know how AMBIEN CR will affect you, you shouldn't drive or operate machinery. Be sure you're able to devote 7 to 8 hours to sleep before being active again. Side effects may include next-day drowsiness, dizziness and headache. It's non-narcotic; however, like most sleep medicines, it has some risk of dependency. Don't take it with alcohol.


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INFORMATION FOR PATIENTS
Ambien CR™ 
(zolpidem tartrate extended-release) tablets



INFORMATION FOR PATIENTS TAKING AMBIEN CR

Your doctor has prescribed Ambien CR to help you sleep. The following information is intended to guide you in the safe use of this medicine. It is not meant to take the place of your doctor's instructions. If you have any questions about Ambien CR tablets be sure to ask your doctor or pharmacist.

Ambien CR is used to treat different types of sleep problems, such as:

- trouble falling asleep
- waking up often during the night

Some people may have more than one of these problems.

Ambien CR belongs to a group of medicines known as the "sedative/hypnotics", or simply, sleep medicines. There are many different sleep medicines available to help people sleep better. Sleep problems are usually temporary, requiring treatment for only a short time, usually 1 or 2 days up to 1 or 2 weeks. Some people have chronic sleep problems that may require more prolonged use of sleep medicine. However, you should not use these medicines for long periods without talking with your doctor about the risks and benefits of prolonged use.

SIDE EFFECTS

Most common side effects:

- headache
- somnolence (sleepiness)
- dizziness

You may find that these medicines make you sleepy during the day. How drowsy you feel depends upon how your body reacts to the medicine, which sleep medicine you are taking, and how large a dose your doctor has prescribed. Daytime drowsiness is best avoided by taking the lowest dose possible that will still help you sleep at night. Your doctor will work with you to find the dose of Ambien CR that is best for you.

To manage these side effects while you are taking this medicine:

- When you first start taking Ambien CR or any other sleep medicine until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
- NEVER drink alcohol while you are being treated with Ambien CR or any sleep medicine. Alcohol can increase the side effects of Ambien CR or any other sleep medicine.
- Do not take any other medicines without asking your doctor first. This includes medicines you can buy without a prescription. Some medicines can cause drowsiness and are best avoided while taking Ambien CR.
- Always take the exact dose of Ambien CR prescribed by your doctor. Never change your dose without talking to your doctor first.

SPECIAL CONCERNS

There are some special problems that may occur while taking sleep medicines.

Memory problems: Sleep medicines may cause a special type of memory loss or "amnesia." When this occurs, a person may not remember what has happened for several hours after taking the medicine. This is usually not a problem since most people fall asleep after taking the medicine.

Memory loss can be a problem, however, when sleep medicines are taken while traveling, such as during an airplane flight and the person wakes up before the effect of the medicine is gone. This has been called "traveler's amnesia."

Be sure to talk to your doctor if you think you are having memory problems. Although memory problems are not very common while taking Ambien CR, in most instances, they can be avoided if you take Ambien CR only when you are able to get a full night's sleep (7 to 8 hours) before you need to be active again.

Tolerance: When sleep medicines are used every night for more than a few weeks, they may lose their effectiveness to help you sleep. This is known as "tolerance". Sleep medicines should, in most cases, be used only for short periods of time, such as 1 or 2 days and generally no longer than 1 or 2 weeks. If your sleep problems continue, consult your doctor, who will determine whether other measures are needed to overcome your sleep problems.

Dependence: Sleep medicines can cause dependence, especially when these medicines are used regularly for longer than a few weeks or at high doses. Some people develop a need to continue taking their medicines. This is known as dependence or "addiction."

When people develop dependence, they may have difficulty stopping the sleep medicine. If the medicine is suddenly stopped, the body is not able to function normally and unpleasant symptoms may occur (see *Withdrawal*). They may find that they have to keep taking the medicines either at the prescribed dose or at increasing doses just to avoid withdrawal symptoms.

All people taking sleep medicines have some risk of becoming dependent on the medicine. However, people who have been dependent on alcohol or other drugs in the past may have a higher chance of becoming addicted to sleep medicines. This possibility must be considered before using these medicines for more than a few weeks.

If you have been addicted to alcohol or drugs in the past, it is important to tell your doctor before starting Ambien or any sleep medicine.

Withdrawal: Withdrawal symptoms may occur when sleep medicines are stopped suddenly after being used daily for a long time. In some cases, these symptoms can occur even if the medicine has been used for only a week or two.

In mild cases, withdrawal symptoms may include unpleasant feelings. In more severe cases, abdominal and muscle cramps, vomiting, sweating, shakiness, and rarely, seizures may occur. These more severe withdrawal symptoms are very uncommon.

Another problem that may occur when sleep medicines are stopped is known as "rebound insomnia." This means that a person may have more trouble sleeping the first few nights after the medicine is stopped than before starting the medicine. If you should experience rebound insomnia, do not get discouraged. This problem usually goes away on its own after 1 or 2 nights.

If you have been taking Ambien CR or any other sleep medicine for more than 1 or 2 weeks, do not stop taking it on your own. Always follow your doctor's directions.

Changes in behavior and thinking: Some people using sleep medicines have experienced unusual changes in their thinking and/or behavior. These effects are not common. However, they have included:

- more outgoing or aggressive behavior than normal
- confusion
- strange behavior
- agitation
- hallucinations
- worsening of depression
- suicidal thoughts

How often these effects occur depends on several factors, such as a person's general health, the use of other medicines, and which sleep medicine is being used.

It is also important to realize that it is rarely clear whether these behavior changes are caused by the medicine, an illness, or occur on their own. In fact, sleep problems that do not improve may be due to illnesses that were present before the medicine was used. If you or your family notice any changes in your behavior, or if you have any unusual or disturbing thoughts, call your doctor immediately.

Pregnancy: Sleep medicines may cause sedation of the unborn baby when used during the last weeks of pregnancy.

Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien CR.

SAFE USE OF SLEEPING MEDICINES

To ensure the safe and effective use of Ambien CR or any other sleep medicine, you should observe the following cautions:

1. Ambien CR is a prescription medicine and should be used ONLY as directed by your doctor. Follow your doctor's instructions about how to take, when to take, and how long to take Ambien CR. Ambien CR tablets should not be divided, crushed, or chewed, and must be swallowed whole.
2. Never use Ambien CR or any other sleep medicine for longer than directed by your doctor.
3. If you notice any unusual and/or disturbing thoughts or behavior during treatment with Ambien CR or any other sleep medicine, contact your doctor.
4. Tell your doctor about any medicines you may be taking, including medicines you may buy without a prescription. You should also tell your doctor if you drink alcohol. DO NOT use alcohol while taking Ambien CR or any other sleep medicine.
5. Do not take Ambien CR unless you are able to get a full night's sleep before you must be active again. For example, Ambien CR should not be taken on an overnight airplane flight of less than 7 to 8 hours since "traveler's amnesia" may occur.
6. Do not increase the prescribed dose of Ambien CR or any other sleep medicine unless instructed by your doctor.
7. When you first start taking Ambien CR or any other sleep medicine, until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
8. Be aware that you may have more sleeping problems the first night after stopping Ambien CR or any other sleep medicine.
9. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien CR or any other sleep medicine.
10. As with all prescription medicines, never share Ambien CR or any other sleep medicine with anyone else. Always store Ambien CR or any other sleep medicine in the original container that you received it in and store it out of reach of children.
11. Ambien CR works very quickly. You should only take Ambien CR right before going to bed and are ready to go to sleep.

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INFORMATION FOR PATIENTS
Ambien® 
(zolpidem tartrate)



INFORMATION FOR PATIENTS TAKING AMBIEN

Your doctor has prescribed Ambien to help you sleep. The following information is intended to guide you in the safe use of this medicine. It is not meant to take the place of your doctor's instructions. If you have any questions about Ambien tablets be sure to ask your doctor or pharmacist.

Ambien is used to treat different types of sleep problems, such as:

- trouble falling asleep
- waking up too early in the morning
- waking up often during the night

Some people may have more than one of these problems.

Ambien belongs to a group of medicines known as the "sedative/hypnotics," or simply, sleep medicines. There are many different sleep medicines available to help people sleep better. Sleep problems are usually temporary, requiring treatment for only a short time, usually 1 or 2 days up to 1 or 2 weeks. Some people have chronic sleep problems that may require more prolonged use of sleep medicine. However, you should not use these medicines for long periods without talking with your doctor about the risks and benefits of prolonged use.

SIDE EFFECTS

Most common side effects: All medicines have side effects. Most common side effects of sleep medicines include

- drowsiness
- dizziness
- lightheadedness
- difficulty with coordination

You may find that these medicines make you sleepy during the day. How drowsy you feel depends upon how your body reacts to the medicine, which sleep medicine you are taking, and how large a dose your doctor has prescribed. Daytime drowsiness is best avoided by taking the lowest dose possible that will still help you sleep at night. Your doctor will work with you to find the dose of Ambien that is best for you.

To manage these side effects while you are taking this medicine:

- When you first start taking Ambien or any other sleep medicine until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
- NEVER drink alcohol while you are being treated with Ambien or any sleep medicine. Alcohol can increase the side effects of Ambien or any other sleep medicine.
- Do not take any other medicines without asking your doctor first. This includes medicines you can buy without a prescription. Some medicines can cause drowsiness and are best avoided while taking Ambien.
- Always take the exact dose of Ambien prescribed by your doctor. Never change your dose without talking to your doctor first.

SPECIAL CONCERNS

There are some special problems that may occur while taking sleep medicines.

Memory problems: Sleep medicines may cause a special type of memory loss or "amnesia." When this occurs, a person may not remember what has happened for several hours after taking the medicine. This is usually not a problem since most people fall asleep after taking the medicine.

Memory loss can be a problem, however, when sleep medicines are taken while traveling, such as during an airplane flight and the person wakes up before the effect of the medicine is gone. This has been called "traveler's amnesia."

Memory problems are not common while taking Ambien. In most instances memory problems can be avoided if you take Ambien only when you are able to get a full night's sleep (7 to 8 hours) before you need to be active again. Be sure to talk to your doctor if you think you are having memory problems.

Tolerance: When sleep medicines are used every night for more than a few weeks, they may lose their effectiveness to help you sleep. This is known as "tolerance." Sleep medicines should, in most cases, be used only for short periods of time, such as 1 or 2 days and generally no longer than 1 or 2 weeks. If your sleep problems continue, consult your doctor, who will determine whether other measures are needed to overcome your sleep problems.

Dependence: Sleep medicines can cause dependence, especially when these medicines are used regularly for longer than a few weeks or at high doses. Some people develop a need to continue taking their medicines. This is known as dependence or "addiction."

When people develop dependence, they may have difficulty stopping the sleep medicine. If the medicine is suddenly stopped, the body is not able to function normally and unpleasant symptoms (see *Withdrawal*) may occur. They may find they have to keep taking the medicine either at the prescribed dose or at increasing doses just to avoid withdrawal symptoms.

All people taking sleep medicines have some risk of becoming dependent on the medicine. However, people who have been dependent on alcohol or other drugs in the past may have a higher chance of becoming addicted to sleep medicines. This possibility must be considered before using these medicines for more than a few weeks.

If you have been addicted to alcohol or drugs in the past, it is important to tell your doctor before starting Ambien or any sleep medicine.

Withdrawal: Withdrawal symptoms may occur when sleep medicines are stopped suddenly after being used daily for a long time. In some cases, these symptoms can occur even if the medicine has been used for only a week or two.

In mild cases, withdrawal symptoms may include unpleasant feelings. In more severe cases, abdominal and muscle cramps, vomiting, sweating, shakiness, and rarely, seizures may occur. These more severe withdrawal symptoms are very uncommon.

Another problem that may occur when sleep medicines are stopped is known as "rebound insomnia." This means that a person may have more trouble sleeping the first few nights after the medicine is stopped than before starting the medicine. If you should experience rebound insomnia, do not get discouraged. This problem usually goes away on its own after 1 or 2 nights.

If you have been taking Ambien or any other sleep medicine for more than 1 or 2 weeks, do not stop taking it on your own. Always follow your doctor's directions.

Changes in behavior and thinking: Some people using sleep medicines have experienced unusual changes in their thinking and/or behavior. These effects are not common. However, they have included:

- more outgoing or aggressive behavior than normal
- loss of personal identity
- confusion
- strange behavior
- agitation
- hallucinations
- worsening of depression
- suicidal thoughts

How often these effects occur depends on several factors, such as a person's general health, the use of other medicines, and which sleep medicine is being used. Clinical experience with Ambien suggests that it is uncommonly associated with these behavior changes.

It is also important to realize that it is rarely clear whether these behavior changes are caused by the medicine, an illness, or occur on their own. In fact, sleep problems that do not improve may be due to illnesses that were present before the medicine was used. If you or your family notice any changes in your behavior, or if you have any unusual or disturbing thoughts, call your doctor immediately.

Pregnancy: Sleep medicines may cause sedation of the unborn baby when used during the last weeks of pregnancy.

Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien.

SAFE USE OF SLEEPING MEDICINES

To ensure the safe and effective use of Ambien or any other sleep medicine, you should observe the following cautions:

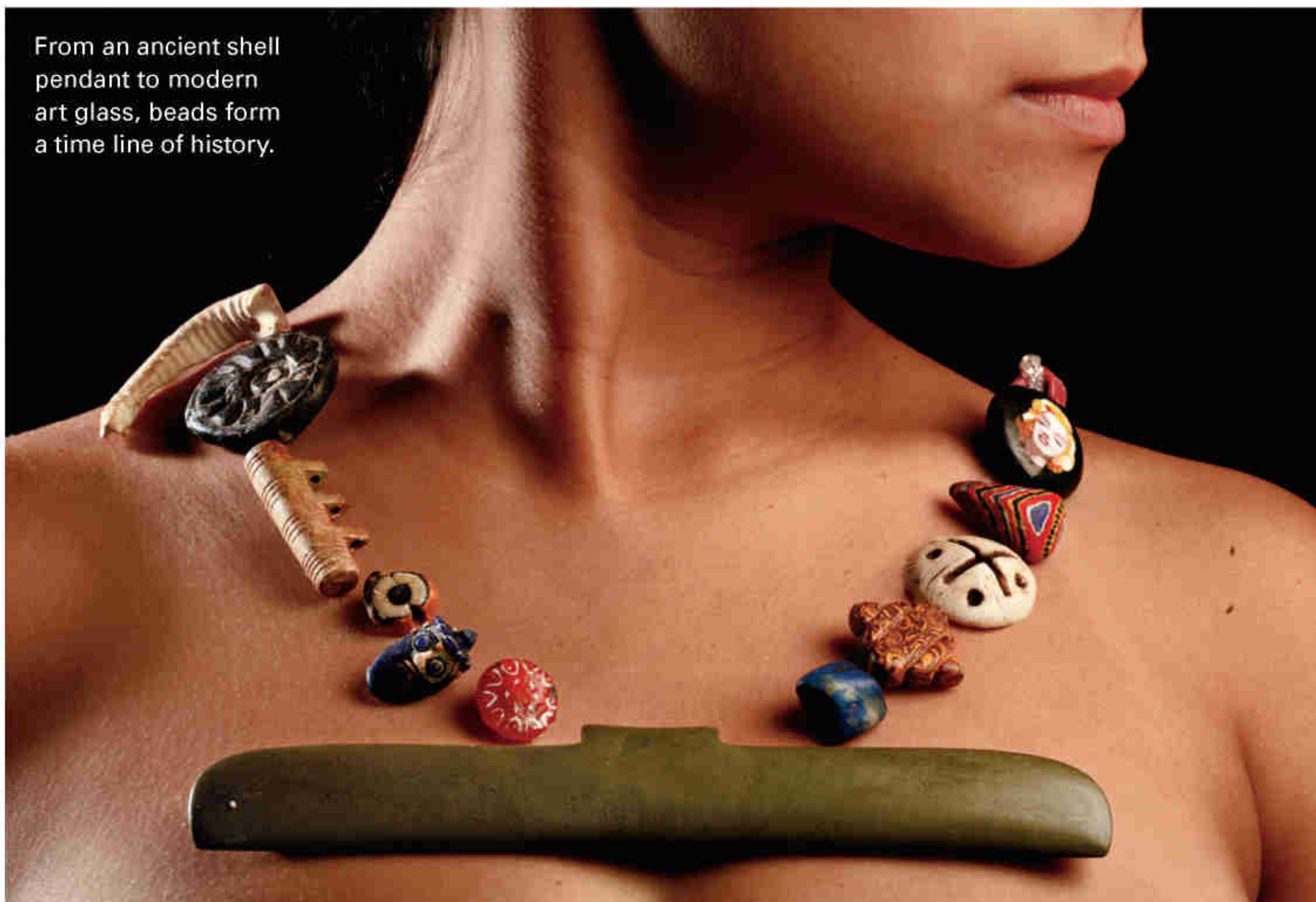
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2. Never use Ambien or any other sleep medicine for longer than directed by your doctor.
3. If you notice any unusual and/or disturbing thoughts or behavior during treatment with Ambien or any other sleep medicine, contact your doctor.
4. Tell your doctor about any medicines you may be taking, including medicines you may buy without a prescription. You should also tell your doctor if you drink alcohol. DO NOT use alcohol while taking Ambien or any other sleep medicine.
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6. Do not increase the prescribed dose of Ambien or any other sleep medicine unless instructed by your doctor.
7. When you first start taking Ambien or any other sleep medicine until you know whether the medicine will still have some carryover effect in you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
8. Be aware that you may have more sleeping problems the first night or two after stopping Ambien or any other sleep medicine.
9. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking Ambien.
10. As with all prescription medicines, never share Ambien or any other sleep medicine with anyone else. Always store Ambien or any other sleep medicine in the original container out of reach of children.
11. Ambien works very quickly. You should only take Ambien right before going to bed and are ready to go to sleep.

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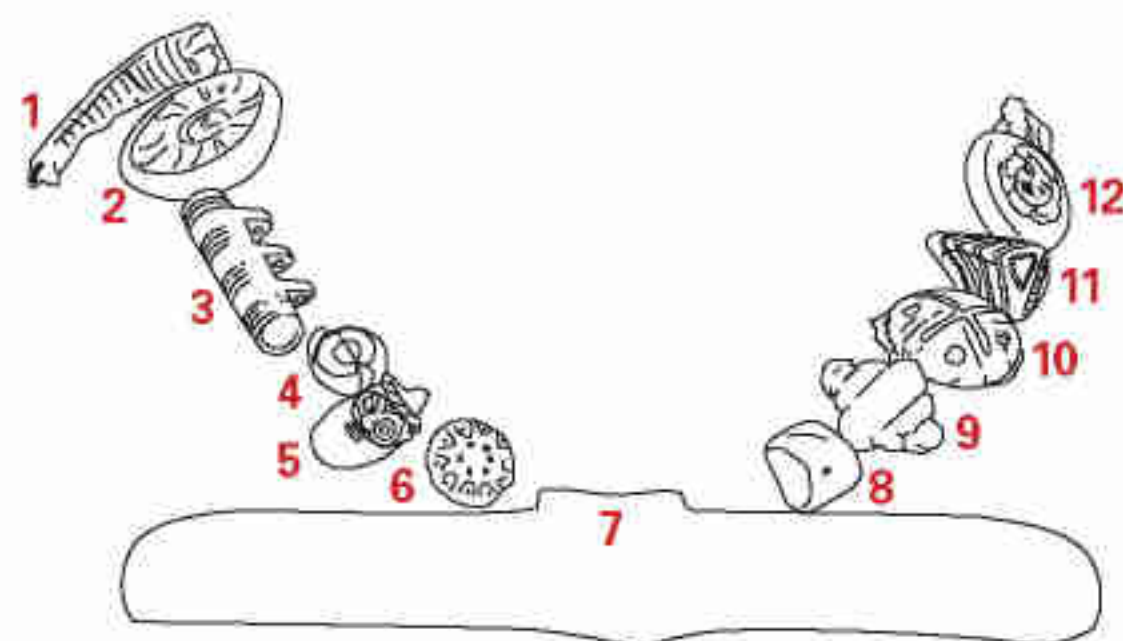
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From an ancient shell pendant to modern art glass, beads form a time line of history.



Unstrung History

Beads tell civilization's story. The earliest, made from shells as early as 100,000 years ago, are evidence—like cave paintings—of abstract thought. During the Bronze Age, cities saw trade of stone beads, prized for the technology that produced them and for their raw materials, such as carnelian. Around 2300 B.C., artisans worked glass into imitation stone beads. Four millennia later, Venetians created glass trade beads that Europeans carried to the ends of the Earth, exchanging for food, land, furs, and slaves. —Karen E. Lange



1. Ninth millennium B.C.
Syria
Mollusk shell lip drilled as pendant

2. 7000-4000 B.C.
Northern Syria
Stone stamp seal

3. Circa 3000 B.C.
Northern Syria
Tubular bone bead with loops

4. Circa 2000 B.C.
Egypt
Glass eye bead, perhaps for warding off evil

5. Circa 600 B.C.
Western Asia
Rod-formed glass pendant with face on both sides

6. Circa A.D. 600
South Asia
Etched carnelian bead

7. Circa 1000 B.C.
Mesoamerica
"Bat wing" bead probably made of jasper

8. Circa A.D. 1000
Western Asia
Lapis lazuli bead

9. Circa A.D. 1000
Western Asia
Bead made from fossilized seashells

10. 1900
Mauritania
Incised shell disk used as hair ornament

11. 1930
Mauritania
Kiffa bead made from powdered glass, inspired by trade beads

12. 2004
United States
Art glass portrait of Marilyn Monroe



Argali (*Ovis ammon*)

Size: Head and body length, 47 - 75 inches; shoulder height, 35 - 45 inches **Weight:** 132 - 397 lbs

Habitat: Open, grassy areas of central Asia; argali prefer rocky outcrops, foothills, plateaus, valleys, gentle slopes and rolling steppes **Surviving number:** Estimated at 10,000 - 50,000



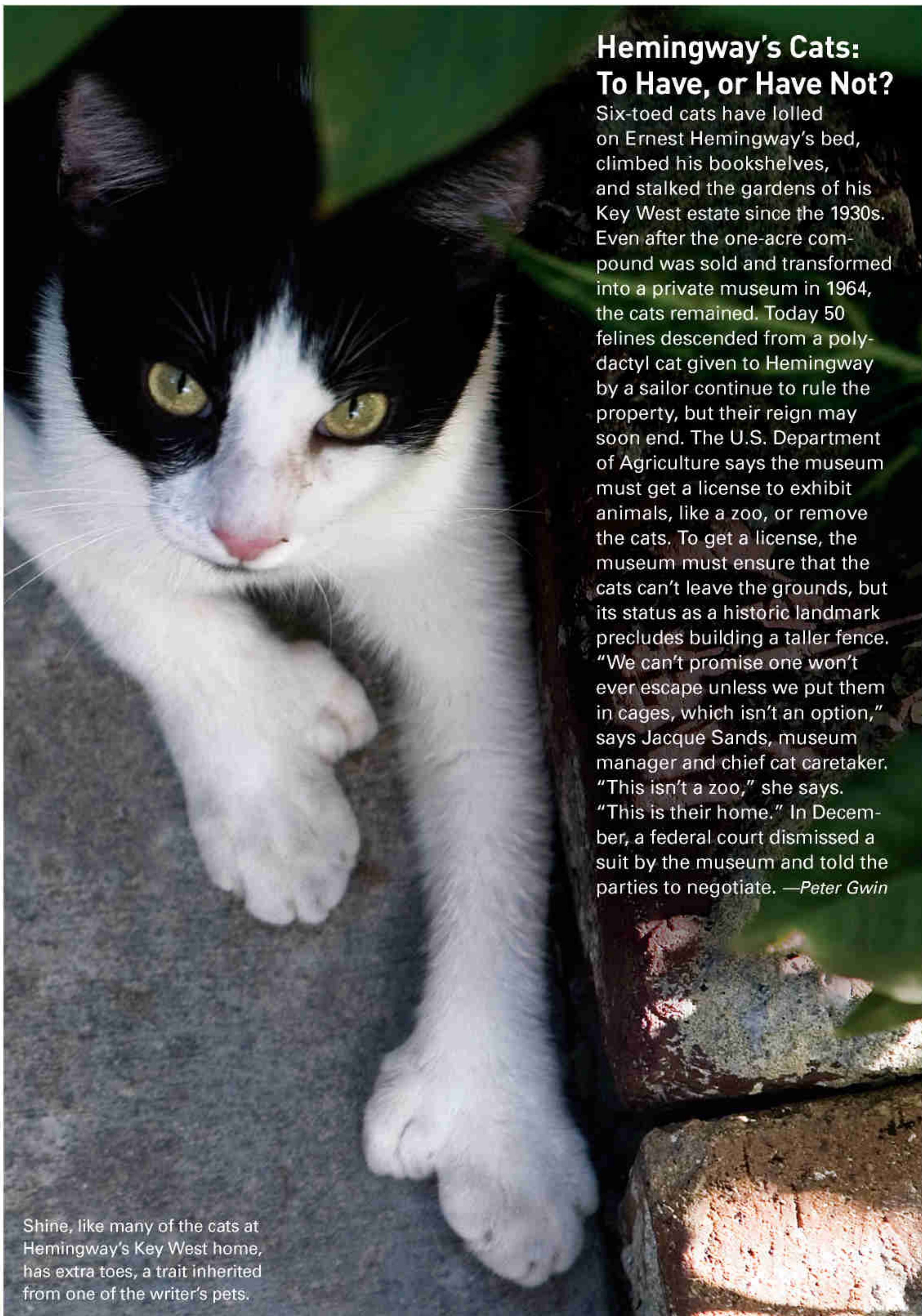
Photographed by Rich Reading

WILDLIFE AS CANON SEES IT

Crash, boom, bam! Epic head-butting battles to determine dominance among argali rams make mating season a noisy affair. Magnificent spiral horns — which both genders possess — become tools of prowess, earning the victorious male the right to mate first with more mature females. Mothers give birth to one lamb in the late spring and care for it until just prior to birthing again the next year. Fathers show little interest in family matters outside mating season.

Unfortunately, the horns that come in so handy then are also prized by poachers. With humans after their horns and livestock after their grazing lands, the argali is between a rock and a hard place.

As an active, committed global corporation, we join worldwide efforts to promote awareness of endangered species. Just one way we are working to make the world a better place—today and tomorrow. Visit ngm.com/canonwildlife to find out more.

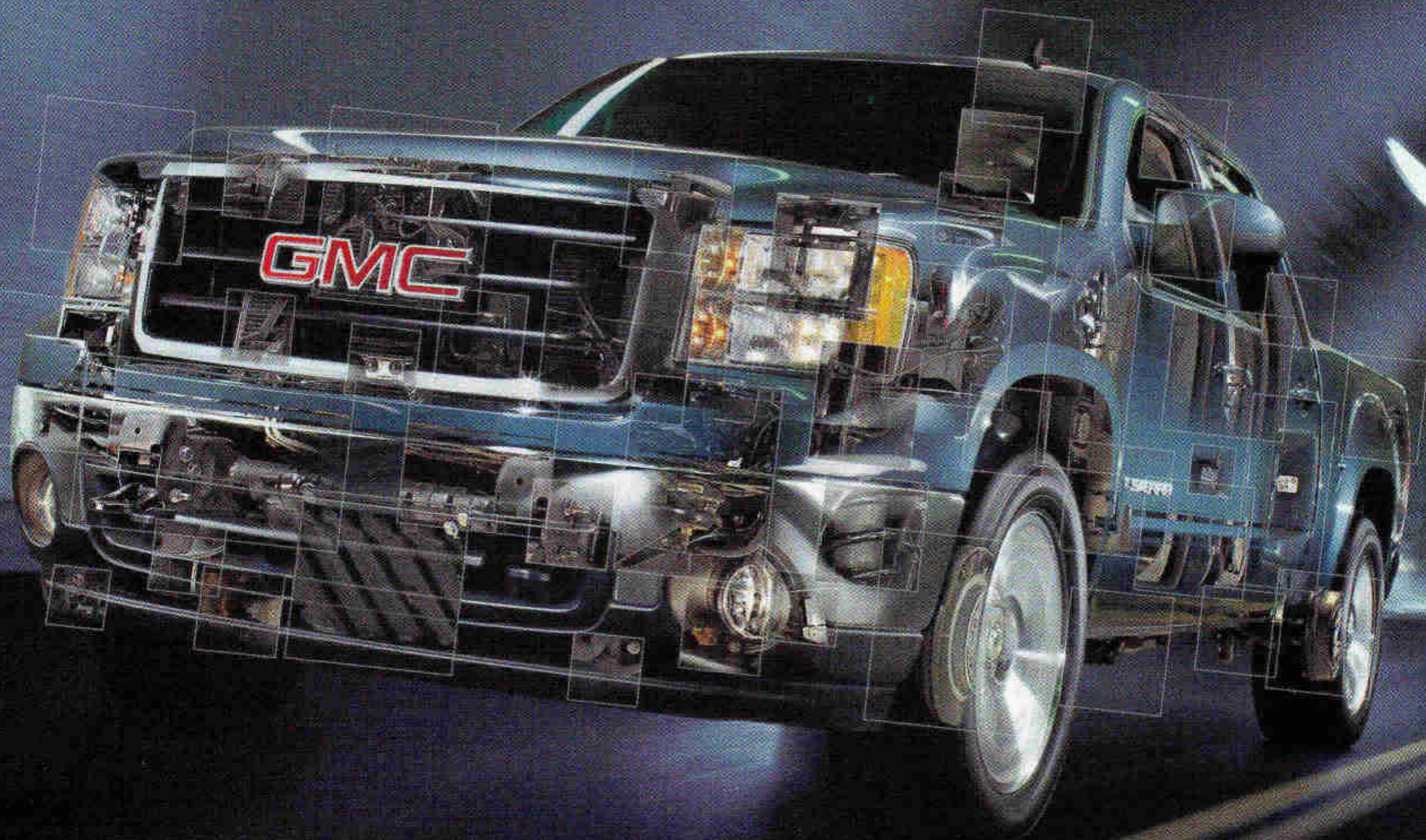


Hemingway's Cats: To Have, or Have Not?

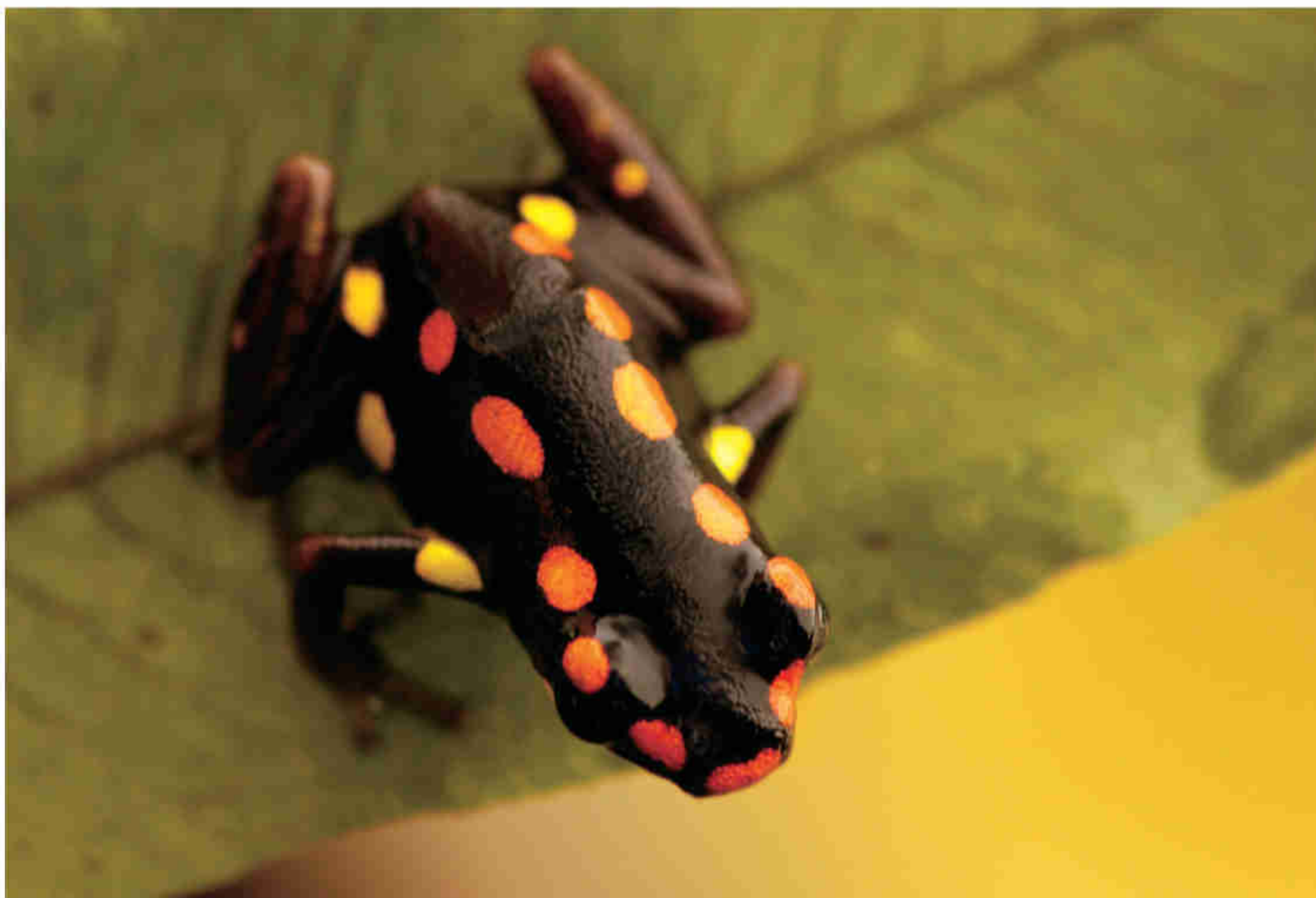
Six-toed cats have lolled on Ernest Hemingway's bed, climbed his bookshelves, and stalked the gardens of his Key West estate since the 1930s. Even after the one-acre compound was sold and transformed into a private museum in 1964, the cats remained. Today 50 felines descended from a polydactyl cat given to Hemingway by a sailor continue to rule the property, but their reign may soon end. The U.S. Department of Agriculture says the museum must get a license to exhibit animals, like a zoo, or remove the cats. To get a license, the museum must ensure that the cats can't leave the grounds, but its status as a historic landmark precludes building a taller fence. "We can't promise one won't ever escape unless we put them in cages, which isn't an option," says Jacqué Sands, museum manager and chief cat caretaker. "This isn't a zoo," she says. "This is their home." In December, a federal court dismissed a suit by the museum and told the parties to negotiate. —Peter Gwin

Shine, like many of the cats at Hemingway's Key West home, has extra toes, a trait inherited from one of the writer's pets.

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OUR ENGINEERS SCOURED EVERY INCH OF THE ALL-NEW 2007 SIERRA LOOKING FOR WAYS TO IMPROVE IT.



Peru's *Dendrobates captivus* (above) measures slightly more than half an inch long at maturity, considerably smaller than other poison frogs.



Peru's Tiny Gems No scientist had seen a live *Dendrobates captivus* since 1929. Museum specimens of the poison frog, says herpetologist Evan Twomey, appeared "gray with lighter gray spots." So when Twomey, Jason Brown, and Justin Yeager—grad students of National Geographic grantee Kyle Summers—ventured into the Peruvian jungle to track down the thumbnail-size amphibian, they weren't sure what they'd find. The frog's remote habitat had "prevented any sane biologists from rediscovering it," Brown says. Near a mountain stream, one of their guides spied the elusive amphibian and told Yeager, whose yells brought Twomey and Brown running from a quarter mile away. Within hours, they'd collected a dozen of the brightly spotted frogs. *D. captivus* captured, they photographed and measured them, observed their behavior, recorded their calls—and let them hop away. —Margaret G. Zackowitz

Critter News

Brown fat, though not poetically named, is a vital tissue that helps all newborn mammals keep warm—all except for pigs, it seems. Piglets, which scientists believe lack brown fat, regulate their body temperature by shivering. Researchers at Sweden's

Uppsala University have demonstrated that some 20 million years ago, a genetic mutation in the ancestor of today's pigs and wild boars shut down the protein found in brown fat that's crucial for converting the fat into body heat. Most likely, the scientists

speculate, this early pig species existed solely in warm climates for hundreds of generations. Today, pigs are the only hoofed animals known to build nests before giving birth, suggesting that pigs adapted to the mutation as they expanded their geographic range.

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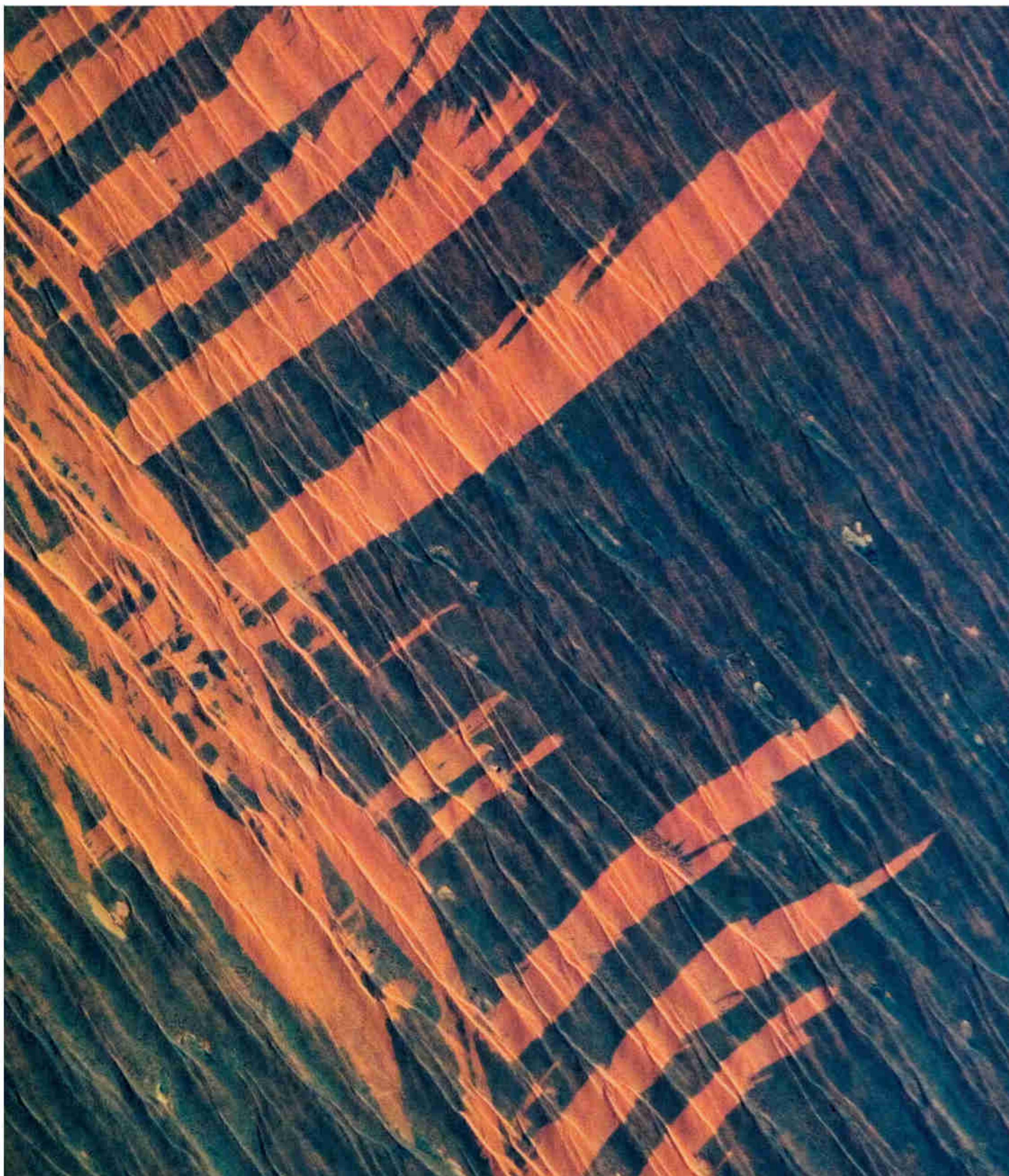
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WHERE IN THE WORLD?



A blaze in the Australian outback left a scorched trail—and a record of the desert's shifting winds.

Burn Scars In Australia's Simpson Desert, orange tendrils mark the path of a fire ignited by lightning. At first, northwesterly winds pushed flames parallel to furrows of saltbush; when southwesterlies swept in, the blaze turned 90 degrees, raged a bit longer, then died as the wind did. Charred bush later blew away to reveal the iron-rich orange sand beneath. "Mapping fire scars used to be done on the ground or from an airplane," says Nigel Tapper of Monash University. "Satellite images like this have changed the way scientists work." —*Alan Mairson*

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The Tortoise and the Bedouin

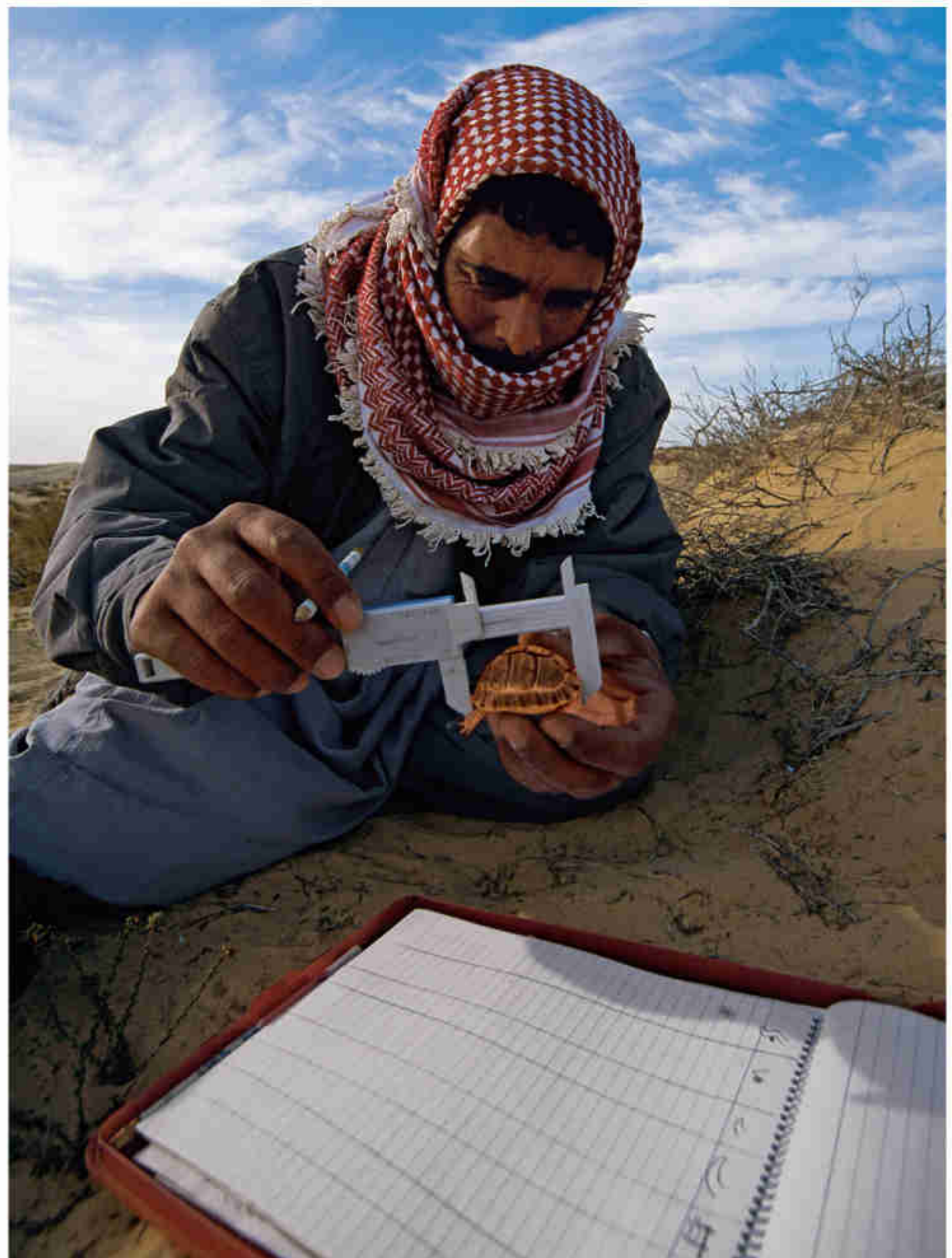
Omar Attum can only guess how many Egyptian tortoises he’s seen for sale in Cairo. “Once I saw a single wildlife dealer with several thousand, but many more were stuffed into bags—too many to count,” the biologist recalls.

These potato-size desert dwellers are among the world’s most endangered tortoises. A thriving illegal pet trade exported most of Egypt’s tortoises to Europe, the United States, and Japan in recent decades, and is currently tapping Libya’s stock. But a small population found in northern Sinai is growing strong with help from local Bedouin who used to catch these animals to be sold on the black market.

Attum and his colleagues now pay Bedouin hunters to be research technicians. They’ve trained the men, none of whom can read, to record biological data using a system of symbols, and to patrol for illegal collectors. Meanwhile, Bedouin women who once gathered the reptiles while tending pastures have increased their earnings by making crafts with tortoise motifs instead. —Jennifer S. Holland



“Tortoises are a blessing, a sign that the land is healthy,” says Suliman Habiban (measuring, below), a bird hunter turned researcher in Sinai.



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Sending Money Home

It's an old story. Workers migrate to another country to find a job, then send the money they make back home—but the payoff is now bigger than ever. Remittances, as these financial transfers are known, have risen from a worldwide total of 132 billion dollars in 2000 to an estimated 257 billion dollars in 2005. One reason for the spike is that more people are working abroad. Another is better tracking: Since 9/11, governments have demanded more rigorous scrutiny of who is sending money where. Yet despite this sleuthing, an estimated 125 billion dollars moved undetected in 2005.

While remittances from the United States dwarf those from all other nations and boost the economies of many developing countries (graphs), the cash may provide just the briefest of balms to the poor. "Too many people use the notion of remittances to argue for increased migration because they assume the money will foster development," says Lindsay Lowell, a demographer at Georgetown University. "But it can also foster a culture of dependence on further remittances, and divert attention from the real challenges facing poor communities." —Alan Mairson



A picture of his son, Sergio—who lives in Mexico—helps motivate migrant Pedro Basilio while he works landscaping jobs in Northern Virginia.

Top ten countries with highest remittance flows in billions of dollars, 2005

□ = \$1 billion





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NG GRANTEE

Clues in a Feather

The imperial eagle is nearly impossible to catch, tag, and track, so how do scientists study this rare raptor? Andrew DeWoody, a geneticist at Purdue University, saw the answer lying in plain sight. In the Naurzum State Nature Reserve in Kazakhstan, DeWoody's team gathered feathers the birds shed at nesting sites, then analyzed their DNA to find the unique genetic fingerprints of individual eagles. Following this molecular trail, the scientists discovered all sorts of bird behavior that can't readily be observed. For instance, not one imperial eagle ever strayed from its mate, a level of monogamy that's rare among birds. "We could use this method to monitor the behavior of other imperiled birds," says DeWoody, "and never ruffle a feather." —*Alan Mairson*



Janine Duffy

"Koala expert"

You Yangs, Victoria



"One of the first things I ever remember is a koala walking into a shop when I was a kid," says Janine Duffy. "I've been fascinated by them ever since. They never fail to surprise you."

Her passion for these iconic Australian creatures has led her to become a leading expert on their behavior in the wild. Back in 1998, Janine began taking notes on wild koalas and developed a way of identifying them—by the unique patterns on their noses. This technique allowed her to easily track the animals and observe the way that they interact with the world around them.

"It's easy to think that koalas are sleepy, lazy creatures," says Janine. "But this is not true. They are constantly aware of everything in their surroundings."

Take a trip down to the You Yangs and you can come and see the koalas yourself. Together with her partner Roger Smith, Janine runs a nature tours company that allows people to see the diverse Victoria wildlife in its natural habitat. Aside from koalas, you'll see various species of birds, as well as wombats, wallabies, and kangaroos.

"Protecting the koalas is vital," says Janine. "Because in order to do that, you have to preserve their environment—the trees—as well. We need the trees, more than almost anything else."



Left: Janine Duffy, binoculars in hand, gets up close and personal with a koala. Above: Pay a visit to the stunning You Yangs area, and this is what you can expect to see . . .

Janine Duffy's passion for koalas has led to her becoming a leading expert on their behavior in the wild. A quick chat with her is all you need to realize the importance of these amazing creatures.

Meet the experts



For more information go to www.nationalgeographic.com/australia



UNPATTERNED FINGERPRINTS



NORMAL FINGERPRINTS

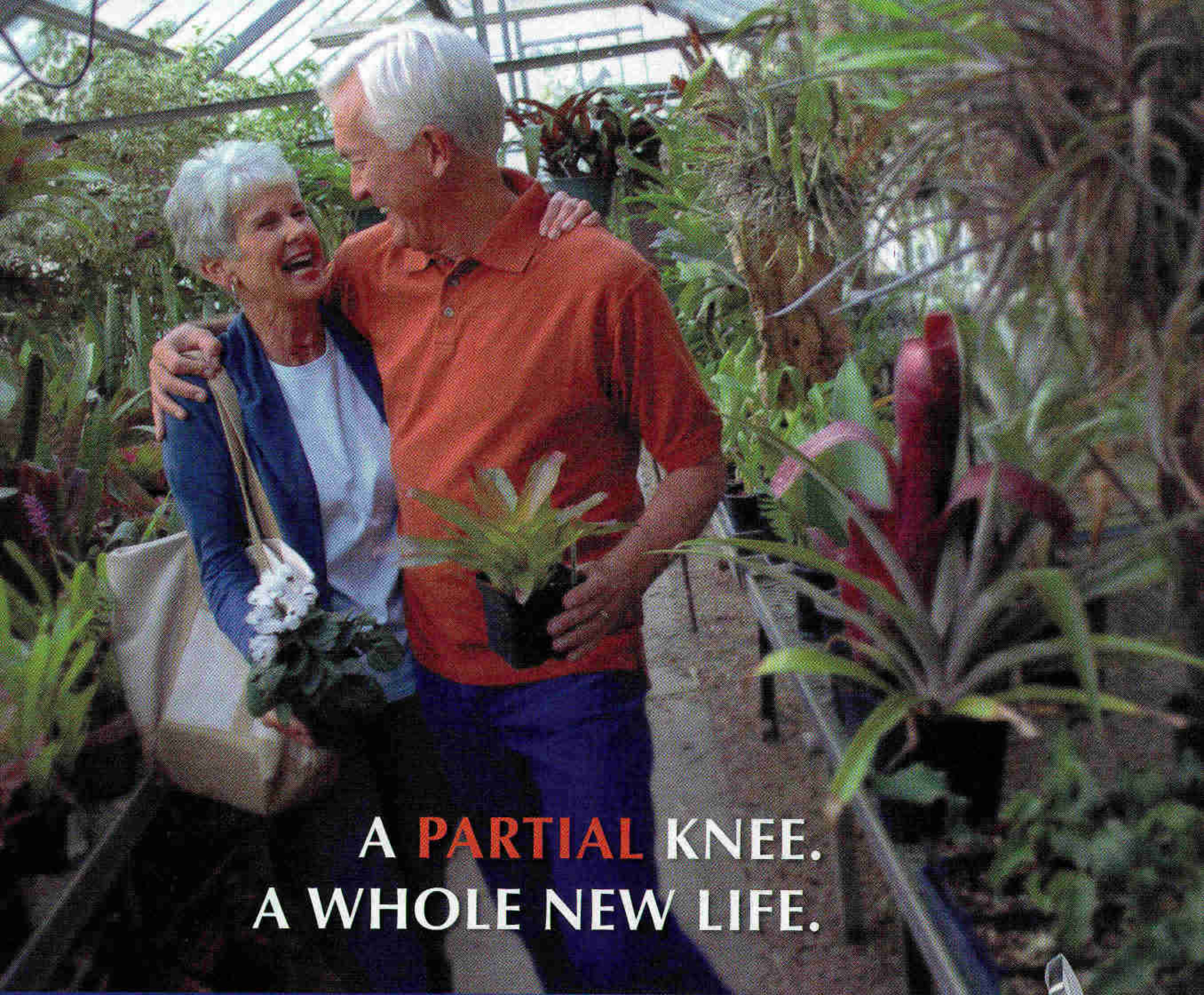
Cheryl Maynard's fingerprints have no pattern (top), a trait inherited from her mother. Her father's prints are normal (above).

Case of the Missing Prints Cheryl Maynard (below) was born with a trait that old-time gangsters would have killed for—fingers that leave no prints. Along with an impaired ability to sweat and a lacy brown pigmentation over her body, the lack of a unique patterning on her fingers and palms comes from an exceedingly rare condition called dermatopathia pigmentosa reticularis—passed on for at least five generations in her mother's family. Like her relatives, Maynard has learned to live with it. Turning slick magazine pages requires her to lick her fingers for

traction on the paper. Her hands slide right off the sides when she tries to carry a cardboard box.

Scientists recently found the root of Maynard's disorder: a genetic defect in a protein that also keeps cells from dying prematurely. Learning how that protein works may improve understanding of why skin cancer cells are hard to kill. Though there is no cure, Maynard still finds humor in situations such as security checks. Puzzled by her lack of prints, an official once asked, "Can't they just give you some?" No, she shot back, "but if I could have anybody's, I'd want Al Capone's." —A. R. Williams





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Meerkats warm themselves in the morning sun after a chilly night in the Kalahari Desert.

Meerkat School Catching live prey, especially poisonous scorpions, isn't the easiest skill to pick up. A study of 11 meerkat groups in the Kalahari Desert has now found that the animals instruct their young gradually in how to master a potentially lethal meal. It's the clearest evidence yet of teaching among mammals other than humans.

The lessons begin with an older meerkat killing prey, often insects or a lizard, and presenting it to the pups. As the pups mature, the teacher gives them live but wounded prey—scorpions are offered with stingers removed. In later lessons, prey provided is live and intact. By the time the pups are three months old, they're ready to feed themselves. There's safety in numbers for meerkats, so each pup's success benefits the whole group. —*Siobhan Roth*

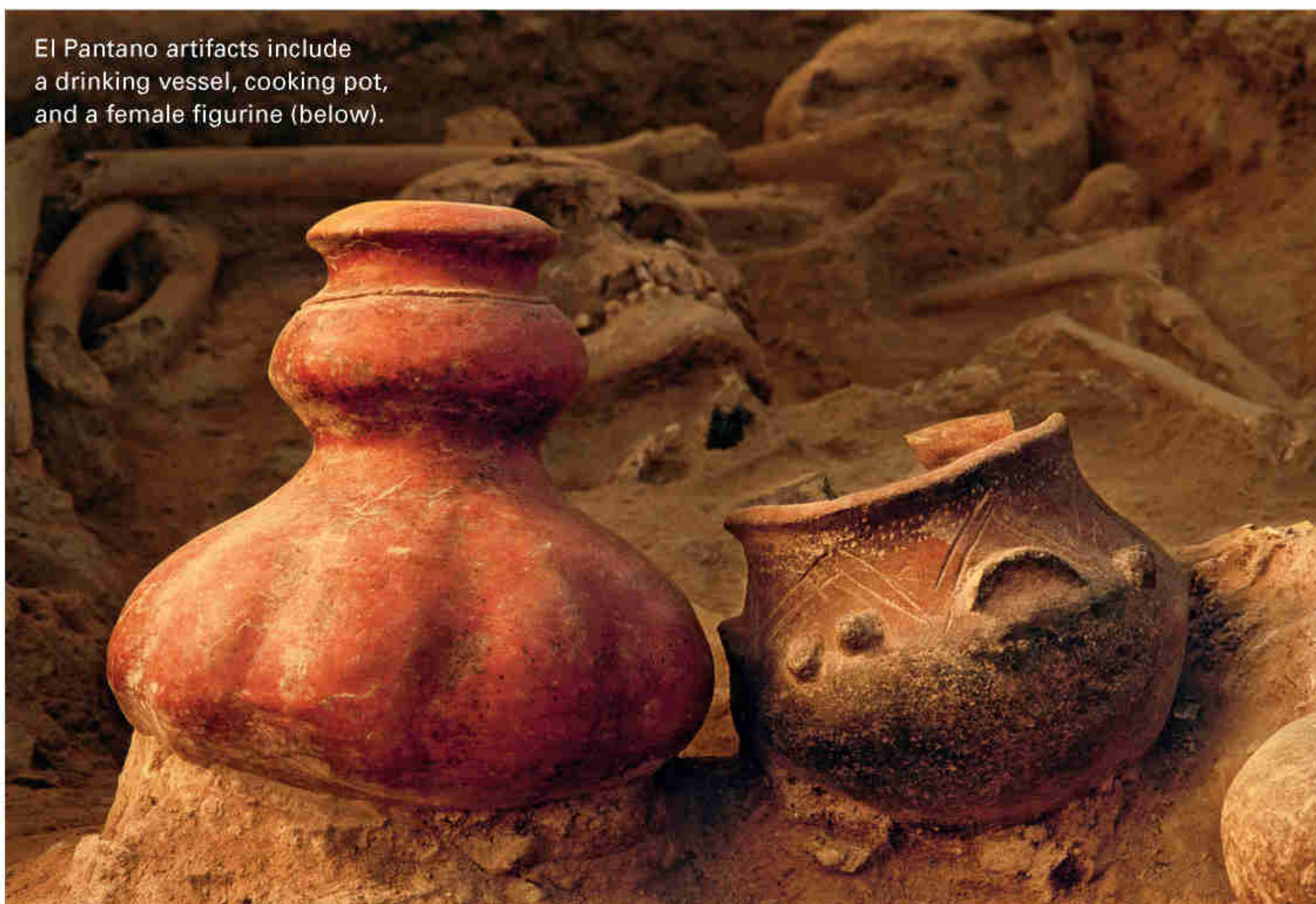
Animal Watch

Symbols of love and fidelity, swans are famous for their monogamous relationships. Yet one in six black swan cygnets has a different father from its nest mates. Someone's cheating, but with whom, and when, and perhaps most important, why? To find out, University of Melbourne

zoologists have attached microchips to the tail feathers of male black swans and decoders to the backs of females. The devices detect the exact time of copulation and its duration. So far, the data show that extracurricular encounters occur at night and last the same as paired swans'

couplings—about 15 seconds. The study aims to reveal whether females are able to manipulate paternity outcomes by mating with different males at particular stages of the breeding cycle, by mating with certain males more or less frequently, or by controlling the duration of copulation.

El Pantano artifacts include a drinking vessel, cooking pot, and a female figurine (below).



NG GRANTEE Mysterious Traders Rancher Juan José de la Torre was bulldozing a ditch in an area known as *el pantano*, the marsh, in Mexico's Mascota Valley when he turned up human bones and pottery figurines and vessels. No one could identify what he had found until Joseph Mountjoy, an archaeologist with the University of North Carolina, Greensboro, had a look. Mountjoy was dumbfounded. The artifacts belonged to an ancient culture he had discovered 80 miles to the north in 1968. He had been searching for more sites ever since without much success.

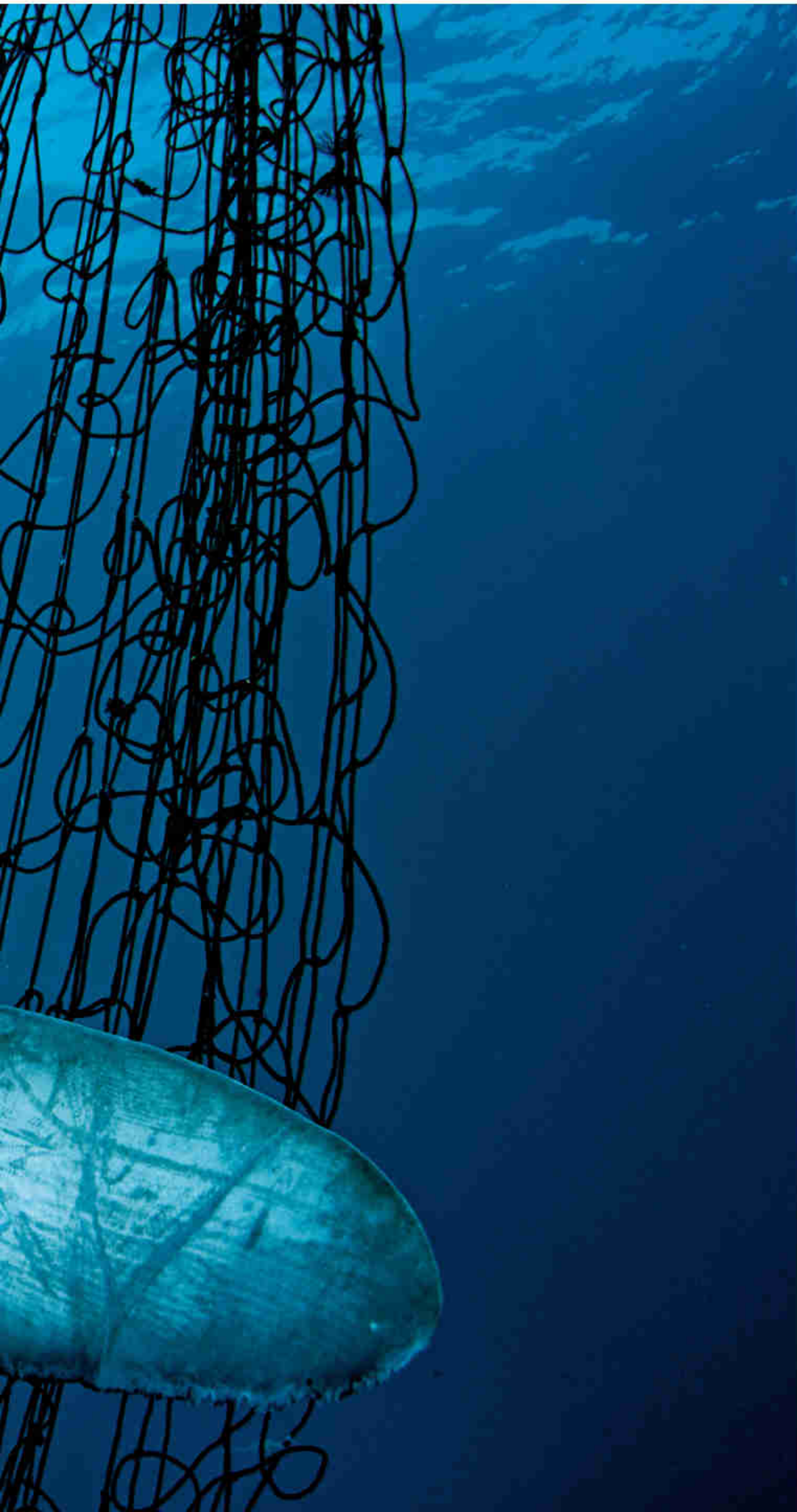
Mountjoy began to excavate where the rancher's bulldozer left off. Over the next six years, he uncovered an entire cemetery from about 800 b.c. More domestic pots and figurines

came to light, as well as evidence of astonishingly early long-distance trade: jade beads, iron pyrite, and faceted quartz jewelry, all likely imported from Central America, as well as distinctive pottery typical of South America. The culture revealed in these graves has now been named after this defining site: El Pantano. —A. R. Williams





STILL WATERS



THE GLOBAL FISH CRISIS

SPECIAL REPORT

Doomed by a gill net, a thresher shark in Mexico's Gulf of California is among an estimated 40 million sharks killed yearly for their fins. They add to the devastating global fish catch: nearly 100 million tons.

BRIAN SKERRY





Thoroughbreds of the seas, wild-caught yellowfin tuna—one of seven major tuna species—are cage-fed squid and sardines in the Gulf of California to improve the quality of their meat. Terry Morris, who runs the operation, says he thought yellowfin would be relatively easy to find. “Boy, was I wrong.”

BRIAN SKERRY



The oceans are in deep blue trouble. From the northernmost reaches of the Greenland Sea to the swirl of the Antarctic Circle, we are gutting our seas of fish. Since 1900, many species may have declined by nearly 90 percent, and it's getting worse. Nets scour reefs. Supertrawlers vacuum up shrimp. Nations flout laws.

The crisis announces itself on the bare table of a family in Senegal, in the shrinking enrollment of an elementary school in a seaside village, on restaurant menus, and in the languid drift of bycatch tossed overboard with casual indifference. In the following three stories, we examine the net losses balanced against the meager gains. First, the breadth and depth of the problem as epitomized by the massacre of the majestic bluefin tuna. Then, the saving grace of a marine reserve in New Zealand, stubbornly propelled into existence by a biologist who insists that what is needed is a new ocean ethic—one that demands we see the ocean not as a commodity, but as a community in which we all have a stake. Finally, the slow strangulation of a fishing village in Newfoundland, a cautionary tale in which the collapse of cod in turn diminishes a livelihood and way of life passed down from generation to generation.

PHOTOGRAPHS BY RANDY OLSON AND BRIAN SKERRY



An underwater photograph showing a large, dark, rusted metal door of a trawler net. The door is suspended by a thick chain and is positioned over a seabed covered in green algae and coral. The water is a deep blue-green color. The net is visible in the upper left corner, and the door is the central focus of the image.

Now banned in many countries, trawling with nets held open by heavy doors bulldozes the seabed and catches sea life indiscriminately—more than 50 percent of all discarded species. Everything surrounding a Mexican trawlerman's hands (opposite) will go to waste; he will sell only the shrimp.

BRIAN SKERRY (BOTH)





RANDY OLSON

Emblematic of First World exploitation of Africa's resources, only the carcasses of Nile perch are affordable sources of protein for some Tanzanians living around Lake Victoria. Perch fillets are stripped in 35 lakeside processing plants and shipped north, mainly to Europe but also to Israel. With years of overfishing, perch stocks have fallen drastically, imperiling the livelihoods of more than 100,000 fishermen and depriving local people of food.

No more magnificent fish swims the world's oceans than the giant bluefin tuna, which can grow to 12 feet in length, weigh 1,500 pounds, and live for 30 years. Despite its size, it is an exquisitely hydrodynamic creation, able to streak

through water at 25 miles an hour and dive deeper than half a mile. Unlike most other fish, it has a warm-blooded circulatory system that enables it to roam from the Arctic to the tropics. Once, giant bluefin migrated by the millions throughout the Atlantic Basin and the Mediterranean Sea, their flesh so important to the people of the ancient world that they painted the tuna's likeness on cave walls and minted its image on coins.

The giant, or Atlantic, bluefin possesses another extraordinary attribute, one that may prove to be its undoing: Its buttery belly meat, liberally layered with fat, is considered the finest sushi in the world. Over the past decade, a high-tech armada, often guided by spotter planes, has pursued giant bluefin from one end of the Mediterranean to the other, annually netting tens of thousands of the fish, many of them illegally. The bluefin are fattened offshore in sea cages before being shot and butchered for the sushi and steak markets in Japan, America, and Europe. So many giant bluefin have been hauled out of the Mediterranean that the population is in danger of collapse. Meanwhile, European and North African officials have done little to stop the slaughter.

"My big fear is that it may be too late," said Sergi Tudela, a Spanish marine biologist with the World Wildlife Fund, which has led the struggle to rein in the bluefin fishery. "I have a very graphic image in my mind. It is of the migration of so many buffalo in the American West in the early 19th century. It was the same with bluefin tuna in the Mediterranean, a migration of a massive number of animals. And now we are witnessing the same phenomenon happening to giant bluefin tuna that we saw happen with America's buffalo. We are witnessing this, right now, right before our eyes."

The decimation of giant bluefin is emblematic of everything wrong with global fisheries today: the vastly increased killing power of new fishing technology, the shadowy network of international companies making huge profits from the trade, negligent fisheries management and enforcement, and consumers' indifference to the fate of the fish they choose to buy.

The world's oceans are a shadow of what they once were. With a few notable exceptions, such as well-managed fisheries in Alaska, Iceland, and New Zealand, the number of fish swimming the seas is a fraction of what it was a century ago. Marine biologists differ on the extent of the decline. Some argue that stocks of many large oceangoing fish have fallen by 80 to 90 percent, while others say the declines have been less steep. But all agree that, in most places, too many boats are chasing too few fish.

Popular species such as cod have plummeted from the North Sea to Georges Bank off New England. (See "End of the Line," page 90.) In the Mediterranean, 12 species of shark are commercially extinct, and swordfish there, which should grow as thick as a telephone pole, are now caught as juveniles and eaten when no bigger than a baseball bat. With many Northern Hemisphere waters fished out, commercial fleets have steamed south, overexploiting once teeming fishing grounds. Off West Africa, poorly regulated fleets, both local and foreign, are wiping out fish stocks from the productive waters of the continental shelf, depriving subsistence fishermen in Senegal, Ghana, Guinea, Angola, and other countries of their families' main source of protein. In Asia, so many boats have fished the waters of the Gulf of Thailand and the Java Sea that stocks are close to exhaustion. "The oceans are suffering from a lot of things, but the one that overshadows everything else is fishing," said Joshua S. Reichert

of the Pew Charitable Trusts. “And unless we get a handle on the extraction of fish and marine resources, we will lose much of the life that remains in the sea.”

“Cruel” may seem a harsh indictment of the age-old profession of fishing—and certainly does not apply to all who practice the trade—but how else to portray the world’s shark fishermen, who kill tens of millions of sharks a year, large numbers finned alive for shark-fin soup and allowed to sink to the bottom to die? How else to characterize the incalculable number of fish and other sea creatures scooped up in nets, allowed to suffocate, and dumped overboard as useless by-catch? Or the longline fisheries, whose miles and miles of baited hooks attract—and drown—creatures such as the loggerhead turtle and wandering albatross?

Do we countenance such loss because fish live in a world we cannot see? Would it be different if, as one conservationist fantasized, the fish wailed as we lifted them out of the water in nets? If the giant bluefin lived on land, its size, speed, and epic migrations would ensure its legendary status, with tourists flocking to photograph it in national parks. But because it lives in the sea, its majesty—comparable to that of a lion—lies largely beyond comprehension.

One of the ironies—and tragedies—of the Mediterranean bluefin hunt is that the very act of procreation now puts the fish at the mercy of the fleets. In the spring and summer, as the water warms, schools of bluefin rise to the surface to spawn. Slashing through the sea, planing on their sides and exposing their massive silver-colored flanks, the large females each expel tens of millions of eggs, and the males emit clouds of milt. From the air, on a calm day, this turmoil of reproduction—the flashing of fish, the disturbed sea, the slick of spawn and sperm—can be seen from miles away by spotter planes, which call in the fleet.

On a warm July morning, in the sapphire-colored waters west of the Spanish island of Ibiza, six purse-seine boats from three competing companies searched for giant bluefin tuna. The purse seiners—named for their conical,

purse-like nets, which are drawn closed from the bottom—were guided by three spotter aircraft that crisscrossed the sky like vultures.

In the center of the action was Txema Galaz Ugalde, a Basque marine biologist, diver, and fisherman who helps run Ecolofish, one of 69 tuna ranching, or fattening, operations that have sprung up throughout the Mediterranean. A small company, Ecolofish owns five purse seiners. Its main rival that morning was the tuna baron of the Mediterranean, Francisco Fuentes of Ricardo Fuentes & Sons, whose industrial-scale operations have been chewing up giant bluefin stocks.

I was with Galaz on *La Viveta Segunda*—a 72-foot support vessel that was part of the fleet of dive boats and cage-towing tugs following the purse seiners. Around 11 a.m., the spotter planes spied a school, setting the purse seiners on a 19-knot dash. The stakes were high. Even a small school of 200 bluefin can, when fattened, fetch more than half a million dollars on the Japanese market. Galaz watched through binoculars as an Ecolofish seiner reached the school first and began encircling it with a mile-long net.

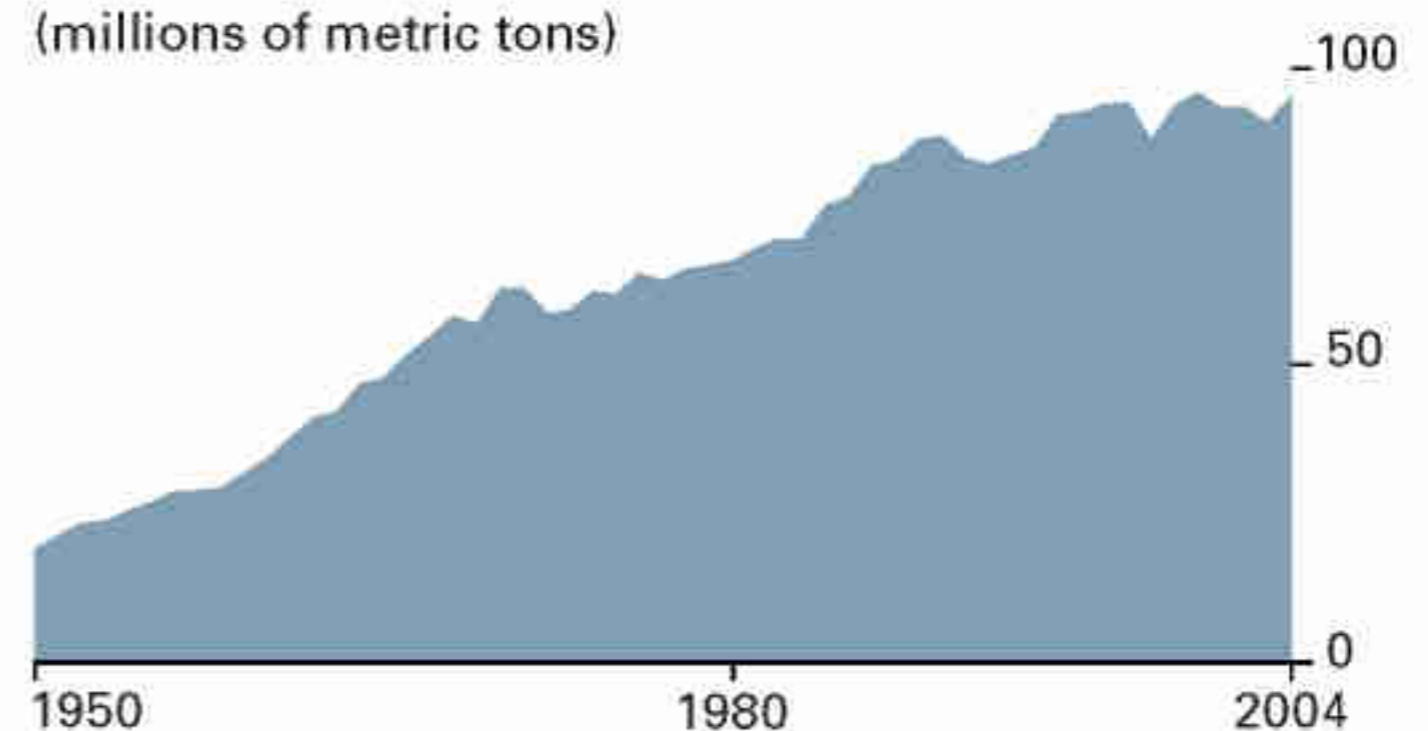
“He’s fishing!” Galaz shouted. “He’s shooting the net!”

It was not an unalloyed victory. Before Ecolofish’s boat could complete its circle, a Fuentes seiner rushed forward and stopped just short of the unfurling net. Under one of the few rules that exist in the free-for-all for Mediterranean bluefin, this symbolic touch entitled the competing boat to split the catch fifty-fifty.

Over the next several hours, Galaz and his

World Fish Catch

(millions of metric tons)



SOURCE: FAO



To supply the world's sushi markets, the magnificent giant bluefin tuna is fished in the Mediterranean at four times the sustainable rate. These bluefin are being fattened off Spain at one of 69 ranches that have sprung up in the Mediterranean in the past decade, demolishing stocks of the fish.

BRIAN SKERRY



So many giant bluefin have been hauled out of the Mediterranean that the

divers transferred the fish—163 bluefin, averaging about 300 pounds—from the purse-seine net into the sea cage, a large holding pen about 160 feet in diameter, with a sturdy plastic frame supporting a heavy mesh net. As the pen, already brimming with a thousand bluefin caught in the days before, was aligned with the purse-seine net, Galaz invited me into the water.

Swimming with the tuna was mesmerizing but unsettling. Giant bluefin are, as Galaz put it, “like missiles, prepared for speed and power.” Their backs were battleship gray topped with a saw-toothed line of small yellow dorsal fins. Their sides had the look of battered chrome and steel; some bore the streak of an electric blue line. The larger fish, weighing more than 500 pounds, were at least eight feet long.

One giant bluefin—some 300 pounds heavier and two feet longer than most of the others—caught my eye. It was not swimming endlessly with the school in a clockwise gyre. Instead, it darted in different directions, sullen and aggressive, nearly brushing against me as it scanned me with large, black, disk-shaped eyes. There was something else: a stainless-steel hook embedded in its mouth, trailing a long strand of monofilament line. In recent weeks, this fish had lunged at one of the thousands of baited hooks set by a longline vessel. Somehow, it had broken free.

After untying the large mesh gates on the pen, Galaz and his divers began herding fish. Peeling off from their gyre, the bluefin whizzed into the cage like torpedoes. The fish with the hook in its mouth was one of the last to leave, but eventually it shot up from the depths and into the cage, dragging a diver who had hitched a ride on the line.

Ecolofish’s catch was part of an annual legal take of 32,000 tons in the Mediterranean and eastern Atlantic. The true quantity, however, is closer to between 50,000 and 60,000 tons. The group charged with managing bluefin tuna stocks, the International Commission for the Conservation of Atlantic Tuna (ICCAT), has acknowledged that the fleet has been violating quotas egregiously. Scientists estimate that if fishing continues at current levels, stocks are

bound to collapse. But despite strong warnings from its own biologists, ICCAT—with 43 member states—refused to reduce quotas significantly last November, over the objections of delegations from the U.S., Canada, and a handful of other nations. Because bluefin sometimes migrate across the Atlantic, American scientists, and bluefin fishermen who abide by small quotas off their coasts, have long been calling for a large reduction in the Mediterranean catch.

“The Mediterranean is at the point that if bluefin stocks are not actually collapsing, they are approaching collapse,” said William T. Hogarth, ICCAT’s recently appointed chairman, who also serves as director of the U.S. National Marine Fisheries Service. “I was really disappointed—when it got to bluefin, science just seemed to go out the window. The bottom line was that, as chairman, I felt I was sort of presiding over the demise of one of the most magnificent fish that swims the ocean.”

The story of giant bluefin tuna began with unfathomable abundance, as they surged through the Straits of Gibraltar each spring, fanning out across the Mediterranean to spawn. Over millennia, fishermen devised a method of extending nets from shore to intercept the fish and funnel them into chambers, where they were slaughtered. By the mid-1800s, a hundred tuna traps—known as *tonnara* in Italy and *almadraba* in Spain—harvested up to 15,000 tons of bluefin annually. The fishery was sustainable, supporting thousands of workers and their families.

Today, all but a dozen or so of the trap fisheries have closed, primarily for lack of fish but also because of coastal development and pollution. One of the few that remains is the renowned *tonnara*, founded by Arabs in the ninth century, on the island of Favignana off Sicily. In 1864, Favignana’s fishermen took a record 14,020 bluefin, averaging 425 pounds. Last year, so few fish were caught—about 100, averaging 65 pounds—that Favignana held only one *mattanza*, which occurs when the tuna are channeled into a netted chamber and lifted to the surface by fishermen who kill them with

population is now in danger of collapse.

gaffs. One sign of the Favignana tonnara's diminishment is that it is run by a Rome marketing executive, Chiara Zarlocco, whose plan for the future is to dress the fishermen in historic costumes as they reenact the mattanza.

The big trouble for Atlantic bluefin began in the mid-1990s. By then, stocks of southern bluefin tuna—which, along with Pacific bluefin and Atlantic bluefin, compose the world's three bluefin species, all treasured for sushi—had been fished to between 6 and 12 percent of the original numbers in the South Pacific and Indian Oceans. As the Japanese searched for new sources, they turned to the Mediterranean, where bluefin reserves were still large.

In 1996, Croatians who had developed techniques for fattening southern bluefin in Australia established the first Mediterranean tuna ranch, in the Adriatic. The process is simple. Newly caught bluefin are transferred to coastal sea cages, where—for months, even years—they are fed oily fish such as anchovies or sardines to give their flesh the high fat content so prized in Japan.

The prospect of producing a steady—and highly profitable—supply of fatty Mediterranean bluefin set off a cascade of events that has proved disastrous. The Mediterranean fleet has increased its fishing effort threefold, with the bluefin flotilla now totaling 1,700 vessels, including 314 purse seiners. Compounding the problem, the advent of tuna ranching made it difficult for the European Union and national governments to enforce quotas. Bluefin are netted at sea, transferred into cages at sea, fattened offshore, killed offshore, and flash-frozen on Japanese ships. As Masanori Miyahara of the Fisheries Agency of Japan, and a former ICCAT chairman, told me: “It's kind of a black box.”

The spread of tuna ranching means that bluefin are being wiped out at all stages of their life cycle. In Croatia, for instance, the industry is based almost entirely on fattening juveniles for two to three years, which means fish are killed before they spawn. Elsewhere, in places such as the Balearic Islands, large females, capable of producing 40 million eggs, are being wiped out. In just ten years, bluefin

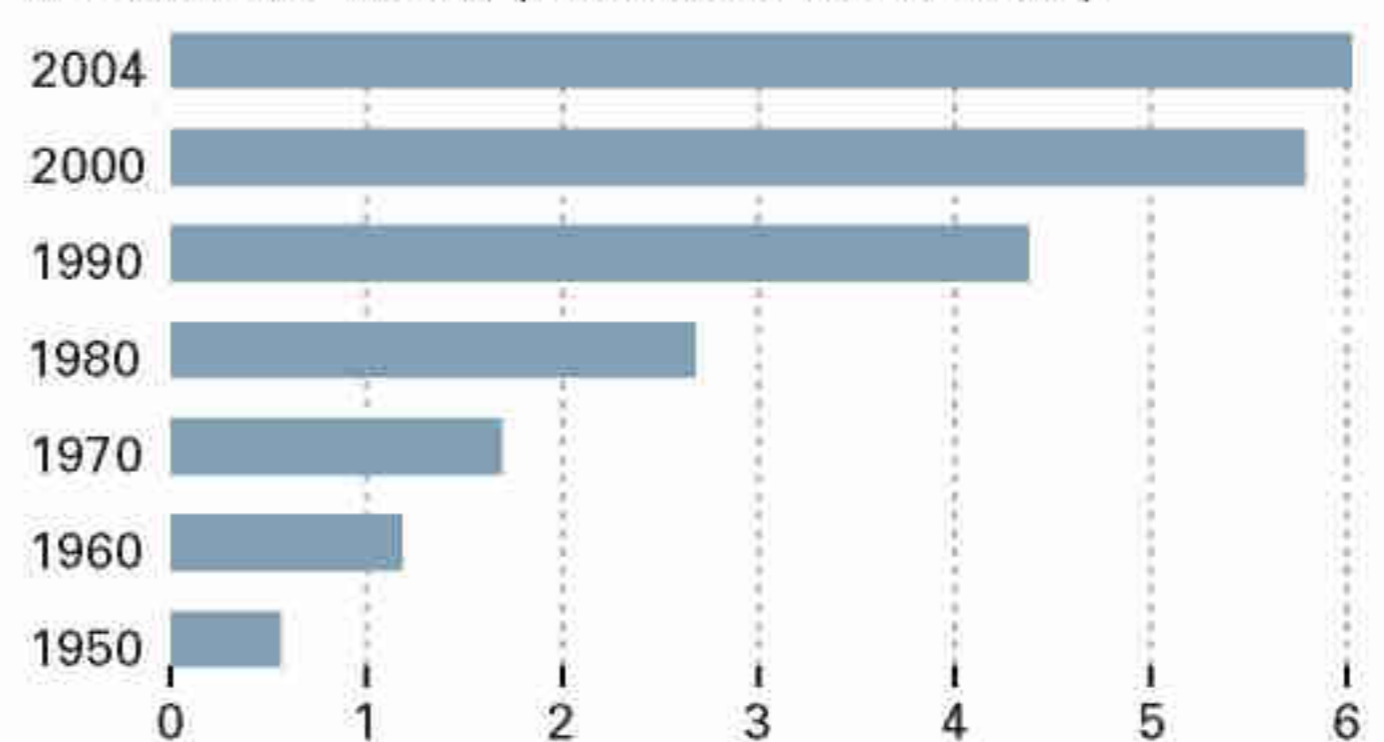
populations have been driven down sharply.

“What's happening is a bit like what happened to cod,” said Jean-Marc Fromentin, a marine biologist and bluefin expert with IFREMER, the French Research Institute for the Exploitation of the Sea. “You don't see the decrease right away because you have had a huge accumulation of biomass. But it's like having a bank account, and you keep taking much more out than you're putting in.”

At the heart of the fishing activity is Francisco Fuentes and his Cartagena-based company, Ricardo Fuentes & Sons, which, according to industry experts, controls 60 percent of the giant bluefin ranching business in the Mediterranean, generating revenues of more than 220 million dollars a year, according to industry sources. (A Fuentes spokesman said revenues are roughly half that.) In partnership with the Japanese giants Mitsui, Mitsubishi, and Maruha, the Fuentes Group—with the help of EU and Spanish subsidies—has bought the sea cages, tugs, and support boats needed for large-scale fattening operations. Fuentes & Sons also formed partnerships with French and Spanish companies that owned 20 purse seiners—five-million-dollar vessels equipped with powerful sonar systems and nets that can encircle 3,000 adult bluefin.

With the Fuentes Group and its partners leading the way, the bluefin fleet methodically targeted the fish in the spawning grounds close to Europe, then turned its attention to untouched areas. The richest of these de facto reserves was Libya's Gulf of Sidra. “It was the tuna aquarium

World Tuna Catch (millions of metric tons)



SOURCE: FAO

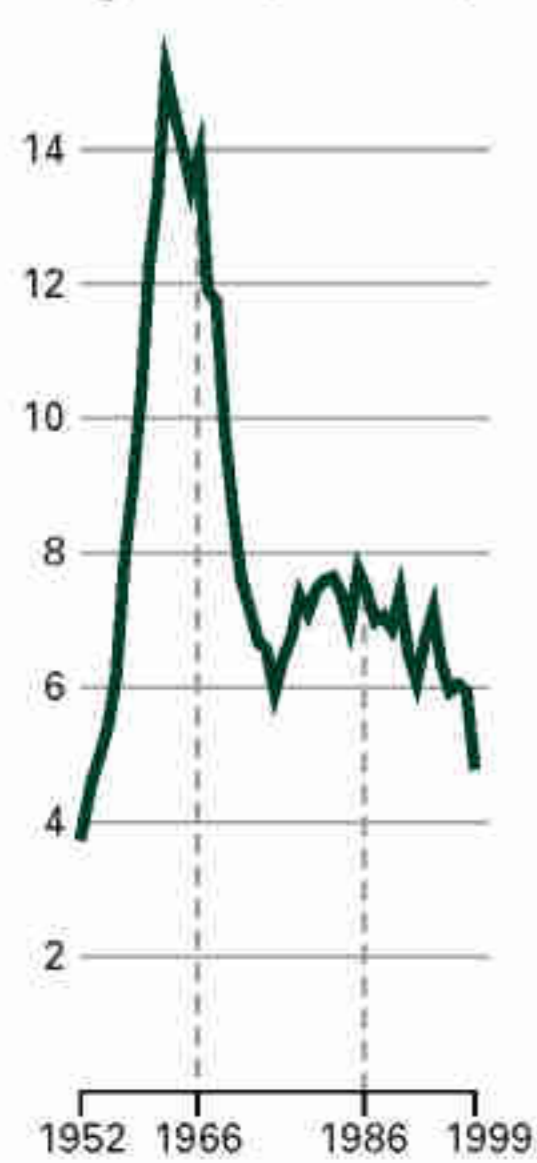
Diminishing returns

Industrial fishing, according to one study, has wiped out perhaps 90 percent of large predatory fish, such as swordfish, marlin, and the biggest types of tuna. To estimate the changing biomass of large predators, researchers used five decades of data from the Japanese longline fishing fleet. The four blue maps illustrate where these predators once thrived and where their remaining numbers are highest.

THE LONGLINE LEGACY

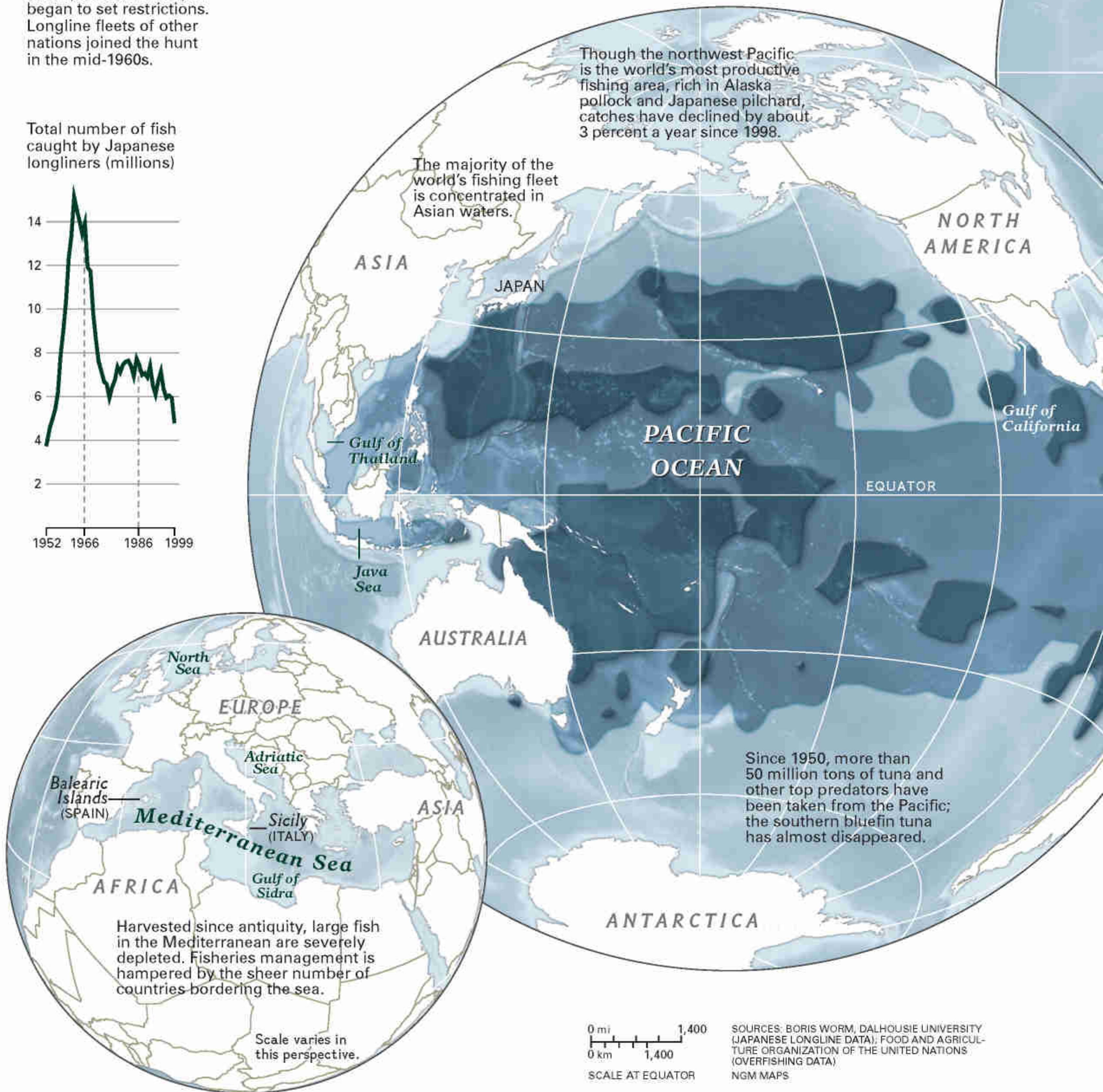
When post-WWII restrictions on Japan were lifted in 1952, the longline fleet quickly expanded across the globe. By 1962 the catch peaked, and Japan began to set restrictions. Longline fleets of other nations joined the hunt in the mid-1960s.

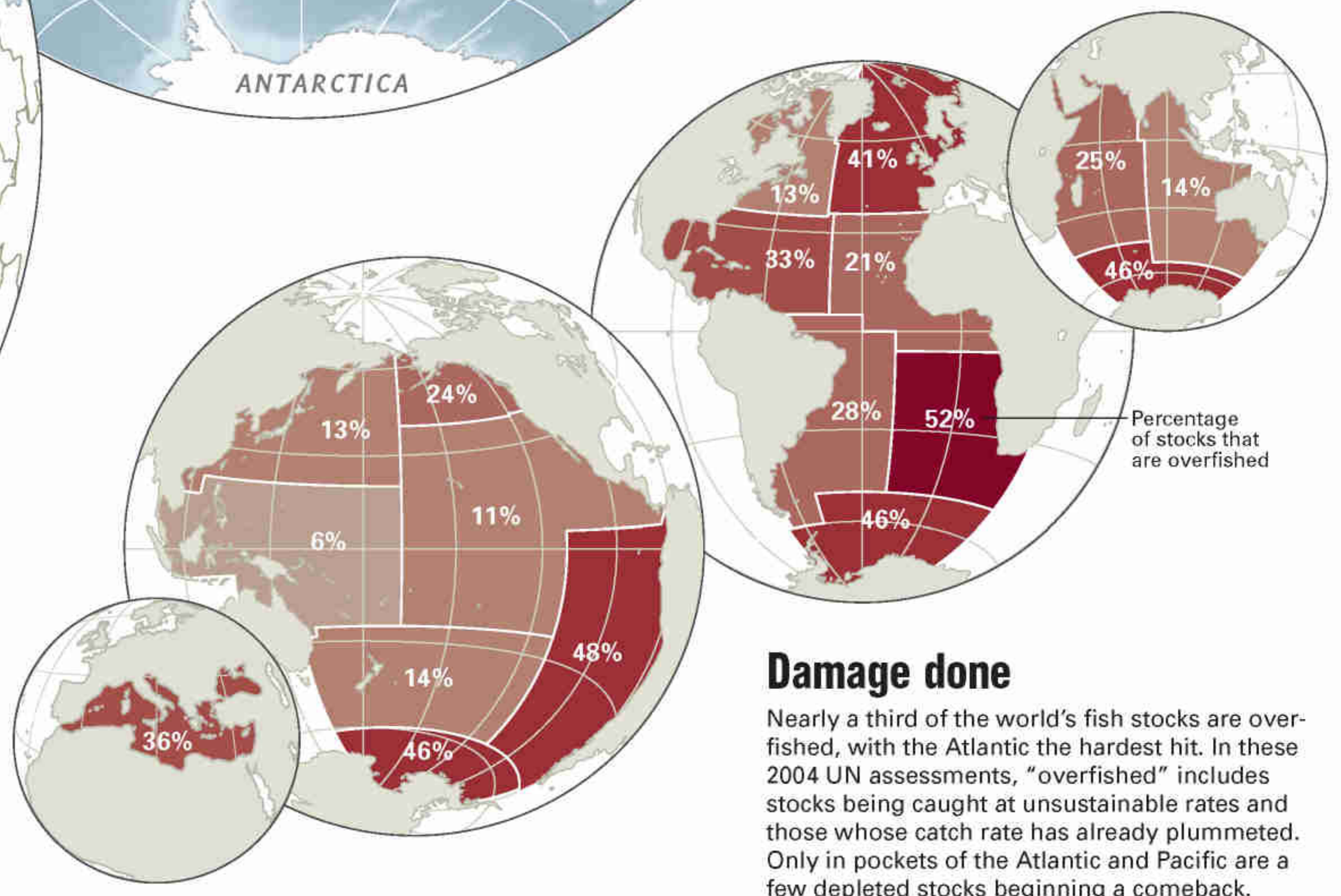
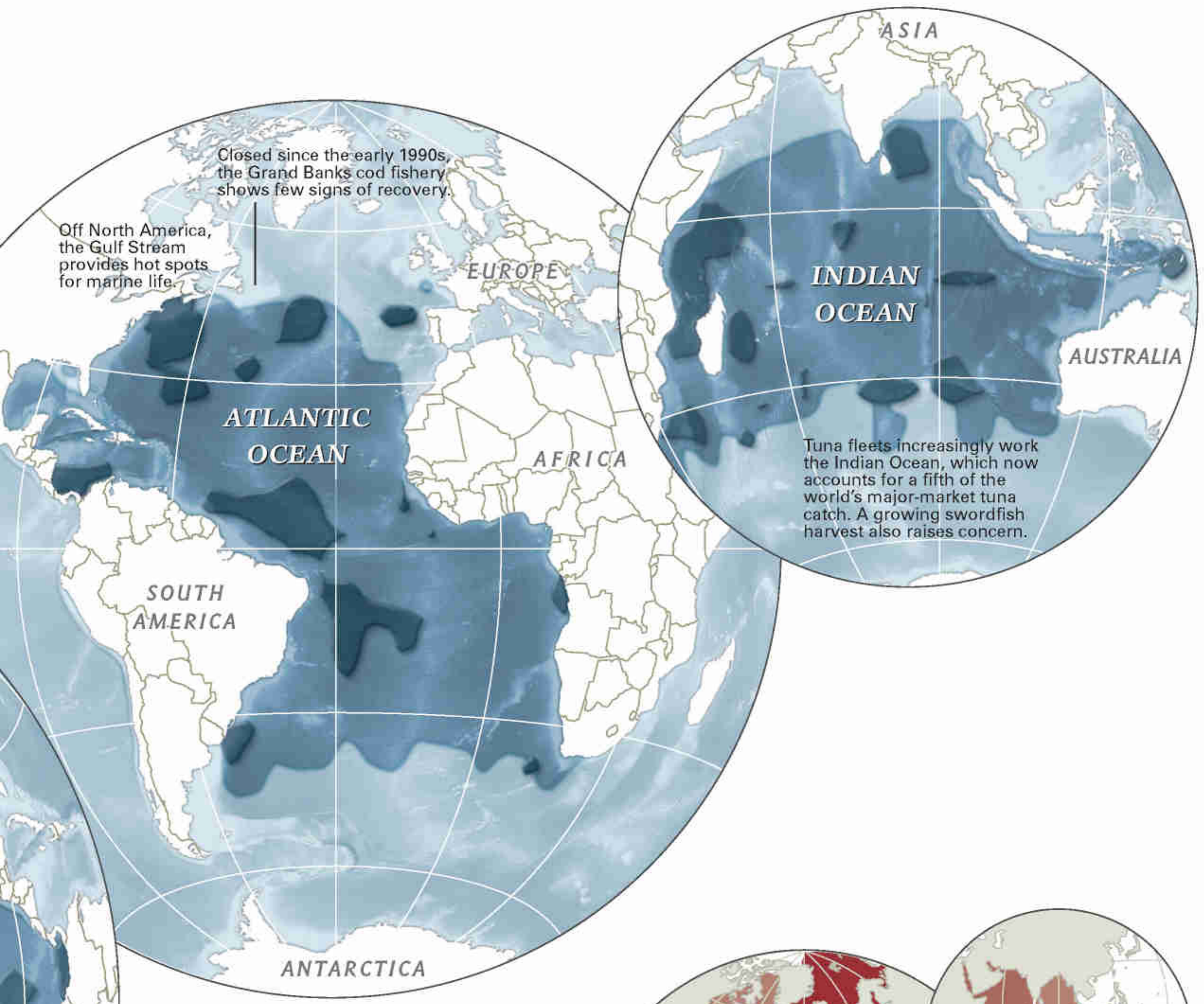
Total number of fish caught by Japanese longliners (millions)



Medium and dark blue areas indicate a catch rate of 3 or more fish per 100 hooks, considered a profitable rate.

- 1986–1999
- 1952–1966
- Catch never exceeded 3 fish per 100 hooks, or no data





Damage done

Nearly a third of the world's fish stocks are overfished, with the Atlantic the hardest hit. In these 2004 UN assessments, "overfished" includes stocks being caught at unsustainable rates and those whose catch rate has already plummeted. Only in pockets of the Atlantic and Pacific are a few depleted stocks beginning a comeback.

“They’re slaughtering everything,” Mielgo Bregazzi said.

of the Mediterranean,” recalled Roberto Mielgo Bregazzi, a tuna ranching consultant who first visited the Gulf of Sidra six years ago. “I’ve never seen anything like it. The average size of bluefin was 600 pounds. It was one of the last tuna Shangri-las.”

Mielgo Bregazzi, a dapper Spaniard and former professional diver who heads Advanced Tuna Ranching Technologies, has been on a mission to expose IUU—illegal, unreported, and unregulated—bluefin fishing. Drawing on a wide network of inside sources, as well as published information, he has written lengthy reports detailing the IUU bluefin business. Using arcane data such as the capacity and schedules of Japanese freezer vessels, he has shown that the Mediterranean tuna fleet has been seizing almost double its annual legal quota.

Mielgo Bregazzi said Ricardo Fuentes & Sons and a French partner have worked with a Libyan company, Ras el Hillal, to catch giant bluefin in Libyan waters. Mielgo Bregazzi said that Seif al Islam Qaddafi, the son of Libyan leader Muammar Qaddafi, has a financial interest in Ras el Hillal and has earned millions of dollars from the bluefin fishery. Mielgo Bregazzi calculated that, for the past four years, bluefin fleets netted more than 10,000 tons of bluefin annually in Libyan waters. Some of the catch is legal under quotas for Libyan, Spanish, and French boats, but much of it appears to be caught illegally.

David Martinez Cañabate, assistant manager of the Fuentes Group, said the company has “absolutely” no connection to the Qaddafi family and that all bluefin tuna it catches, buys, or

ranches have been legally caught and properly documented with ICCAT and Spanish authorities. He conceded that bluefin have been overfished, mainly by companies that do not ranch tuna but sell the fish soon after netting them. Fleets from other countries also catch bluefin without an ICCAT quota and ranch them illegally, Martinez said. He said much of Mielgo Bregazzi’s information is “incorrect or, worse, bad intentioned” and that the Fuentes Group has supported stricter conservation measures. “We are more interested than anyone in the future of the tuna,” Martinez said. “We live off this resource.”

Actually, Libyan and other Mediterranean bluefin have so flooded the market that Japanese companies have stockpiled 20,000 tons in giant freezers. The glut has halved prices for fishermen in the past few years, to between three and four dollars a pound. Still, the value of the bluefin caught annually in Libya, then fattened for several months, is roughly 400 million dollars on the Japanese market.

“They’re slaughtering everything,” Mielgo Bregazzi said. “The fish don’t stand a chance.”

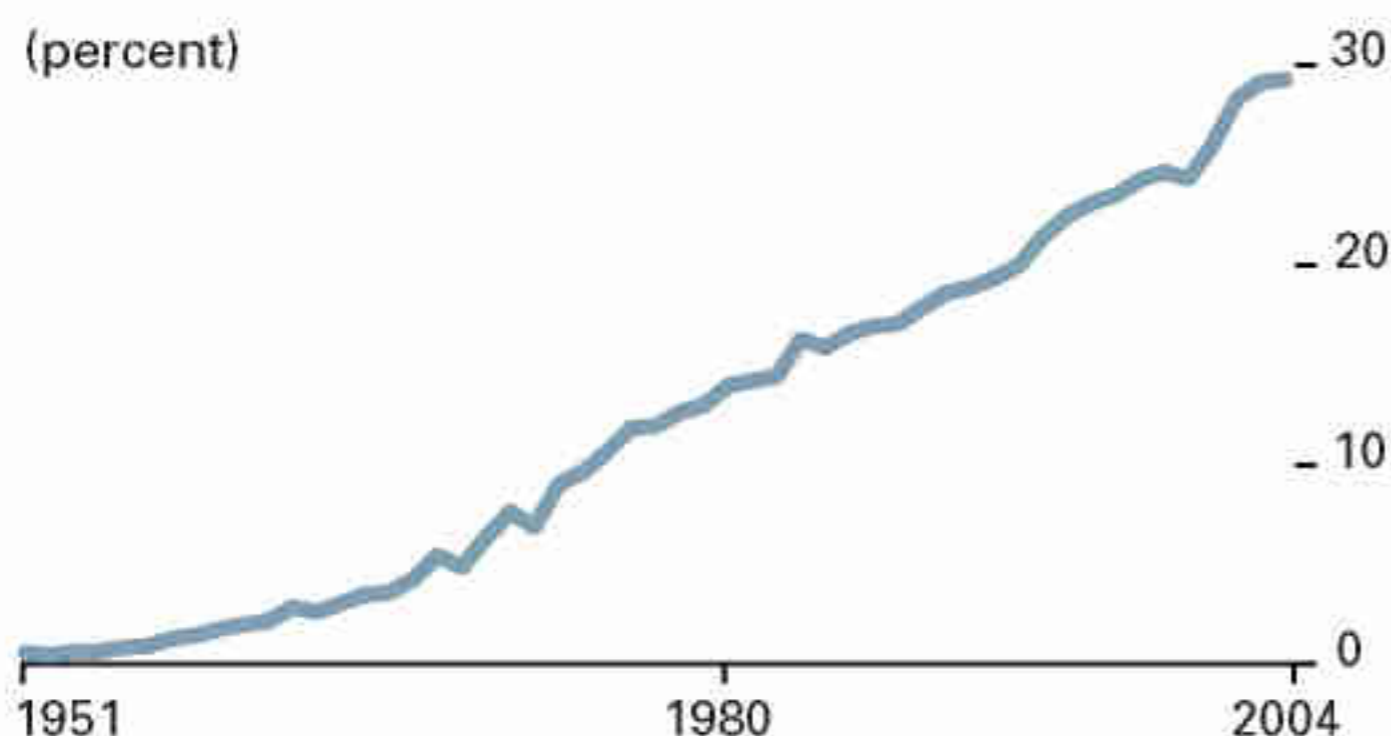
The extent to which giant bluefin fleets flout regulations became evident during a visit to the Italian island of Lampedusa, south of Sicily. To give the tuna a reprieve during peak spawning season, EU and ICCAT rules prohibit spotter aircraft from flying in June. The regulation is often ignored.

I flew one June morning with Eduardo Domaniewicz, an Argentine-American pilot who has spotted tuna for French and Italian purse seiners since 2003. Riding shotgun was Domaniewicz’s spotter, Alfonso Consiglio. They were combing the waters between Lampedusa and Tunisia, and they were not alone: Three other spotter aircraft were prowling illegally, relaying tuna sightings to some of the 20 purse seiners in the water below. (After two hours, high winds and choppy seas, which make it difficult both to see and net the bluefin, forced the planes to return to Lampedusa and Malta.)

Domaniewicz was conflicted. He loved to fly

World Stocks Overfished

(percent)



SOURCE: BORIS WORM, DALHOUSIE UNIVERSITY

“The fish don’t stand a chance.”

and was well paid. He believed his June flights were legal, because Italy never agreed to the ban. But after three years of spotting for the bluefin fleet, he was fed up with the uncontrolled fishing. Just before I arrived on Lampedusa, he had watched two purse-seine fleets net 835,000 pounds of bluefin, sharing more than two million dollars.

“There is no way for the fish to escape—everything is high-tech,” Domaniewicz said. Speaking of the French purse-seine fishermen he worked for in Libya, he said, “I am an environmentalist, and I couldn’t stand the way they fished with no care for the quotas. I saw these people taking everything. They catch whatever they want. They just see money on the sea. They don’t think what will be there in ten years.”

Alfonso Consiglio, whose family owns a fleet of purse seiners, also is torn. “The price is cheap because more and more tuna are being caught,” he said. “My only weapon is to catch more fish. It’s a vicious circle. If I catch my quota of a thousand tuna, I can’t live because the price is very cheap. I want to respect the quota, but I can’t because I need to live. If boats of all countries respect the rules, tuna will not be finished. If only few countries respect the rules, and others don’t respect the rules, the fisherman who respects rules is finished.”

How can this endless cycle of overfishing be stopped? How can the world’s fleets be prevented from committing ecological and economic suicide by depleting the oceans of bluefin tuna, shark, cod, haddock, sea bass, hake, red snapper, orange roughy, grouper, grenadier, sturgeon, plaice, rockfish, skate, and other species?

Experts agree that, first, the world’s oceans must be managed as ecosystems, not simply as larders from which the fishing industry can extract protein at will. Second, the management councils that oversee fisheries, such as ICCAT, long dominated by commercial fishing interests, must share power with scientists and conservationists.

Further, governments must cut back the world’s four million fishing vessels—nearly

double what is needed to fish the ocean sustainably—and slash the estimated 25 billion dollars in government subsidies bestowed annually on the fishing industry.

In addition, fisheries agencies will have to set tough quotas and enforce them. For giant bluefin in the Mediterranean, that may mean shutting down the fishery during the spawning season and substantially increasing the minimum catch weight. ICCAT recently failed to decrease quotas significantly or close the fishery at peak spawn, although it did increase the minimum catch weight in most areas to 66 pounds and ban spotter aircraft. But without inspection and enforcement, the commission’s new rules will, like the old ones, mean little.

Another crucial step, both in the Mediterranean and around the world, would be the creation of large marine protected areas. (See “Blue Haven,” page 70.) Also important are campaigns by such groups as the Marine Stewardship Council, which is working with consumers as well as retail giants to promote trade in sustainably caught fish.

The news from the fisheries front is not unremittingly grim. Indeed, where sound fisheries management exists, fish populations—and the fishing industry—are healthy. A prime example is Alaska, where stocks of Pacific salmon and pollock are bountiful. Iceland’s cod fishery is thriving, because it, too, follows a cardinal conservation rule: Limit the number of boats that can pursue fish.

But all agree that the fundamental reform that must precede all others is not a change in regulations but a change in people’s minds. The world must begin viewing the creatures that inhabit the sea much as it looks at wildlife on land. Only when fish are seen as wild things deserving of protection, only when the Mediterranean bluefin is thought to be as magnificent as the Alaska grizzly or the African leopard, will depletion of the world’s oceans come to an end.

🔦 **Sights & Sounds** Learn why the world’s fisheries are in deep trouble and what can be done about it in a multimedia presentation at ngm.com/0704.





With competition intensifying to supply mostly European markets, fishing grounds off West Africa are going the way of Europe's: toward depletion. These Senegalese, who had hoped to catch desirable export species such as shrimp or sole, will throw away the fish in their nets—wasting valuable protein for Africa.

RANDY OLSON



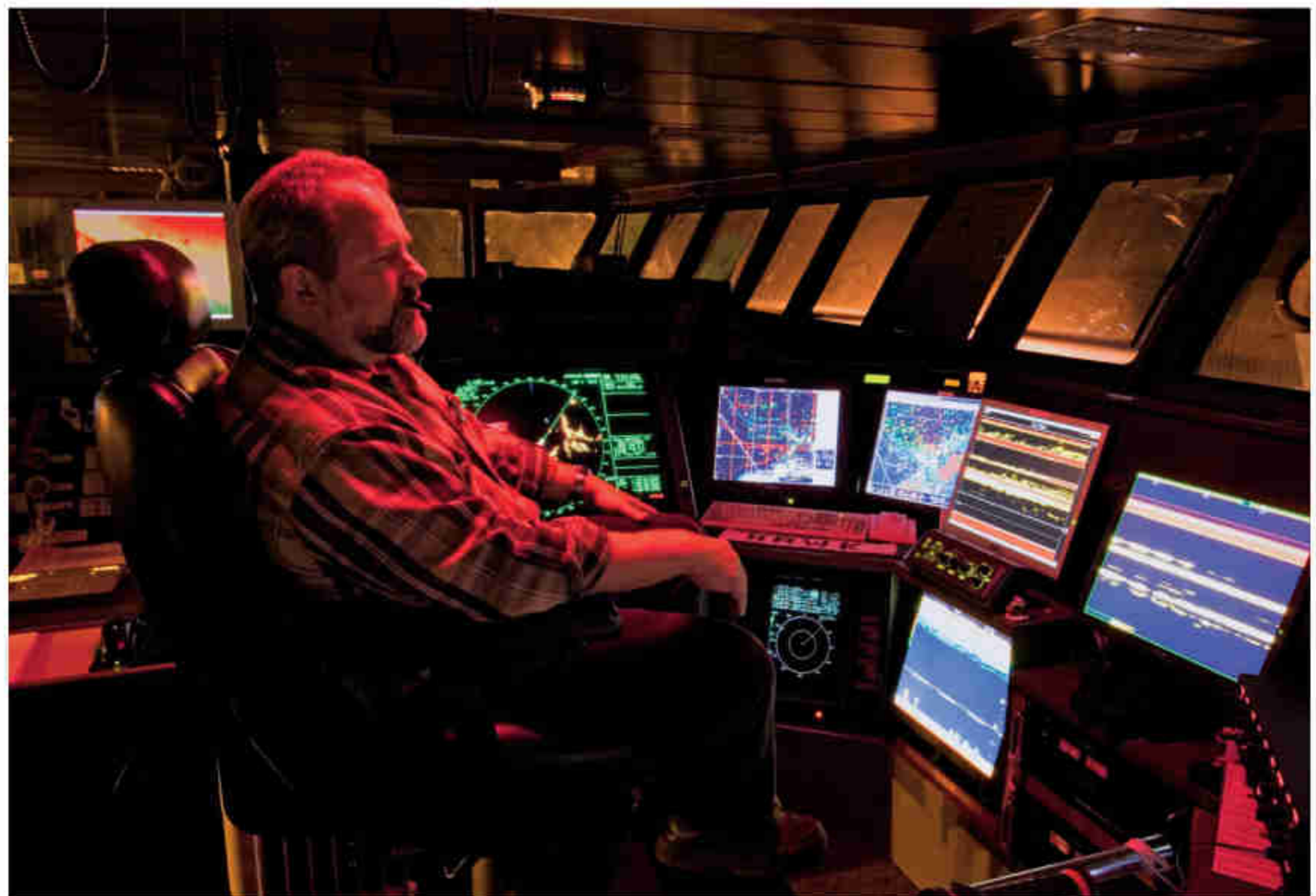
Tradition vs. technology: net results

Senegalese artisanal fishermen working in wooden pirogues must now go farther offshore—even into foreign waters—and stay out longer to fill their nets. The nation's fleet of small boats, unregulated until recently, hauls in 80 percent of the catch and supplies about 60 percent of the export market. Senegal's commercial vessels, foreign fleets from Europe and Asia, and pirate fishing boats add to the pressure; the country's annual harvest declined from 426,000 tons in 1997 to 395,000 tons in 2004.

Hunted with the help of GPS, echo sounders, and other sophisticated gear, fish don't stand a chance against trawlers like *Northern Hawk*, skippered by Barry Fitzgerald off Alaska. One target: pollock, a fish once used as animal feed but now in high demand for products such as frozen fish sticks—an example of how overfishing creates new markets for formerly less desirable species.



RANDY OLSON



BRIAN SKERRY

Hooked without a permit, a dorado—sold as mahi-mahi—was caught on an illegal longline off Mexico. With thousands of baited hooks, longlines extend for miles, often snaring fish unintentionally, notably sharks, as well as hundreds of thousands of sea turtles, marine mammals, and seabirds every year. In longline fishing, eventually discarded bycatch makes up nearly 30 percent of the take.





BRIAN SKERRY

An underwater photograph showing a fishing net with various fish and marine life. The net is made of a fine mesh and is suspended by a chain. Several fish are visible, including a large guitarfish in the foreground, a white fish, and a flatfish. The water is clear and blue, with sunlight filtering through from above. The net is attached to a wooden structure, likely part of a boat.

In a cascade of death, guitarfish, rays, and other bycatch are tossed from a shrimp boat in the Gulf of California. During the past decade, efforts to reduce bycatch have begun to pay off with better net and hook designs, pingers on nets to repel marine mammals, and streamers behind boats to frighten away seabirds.

BRIAN SKERRY





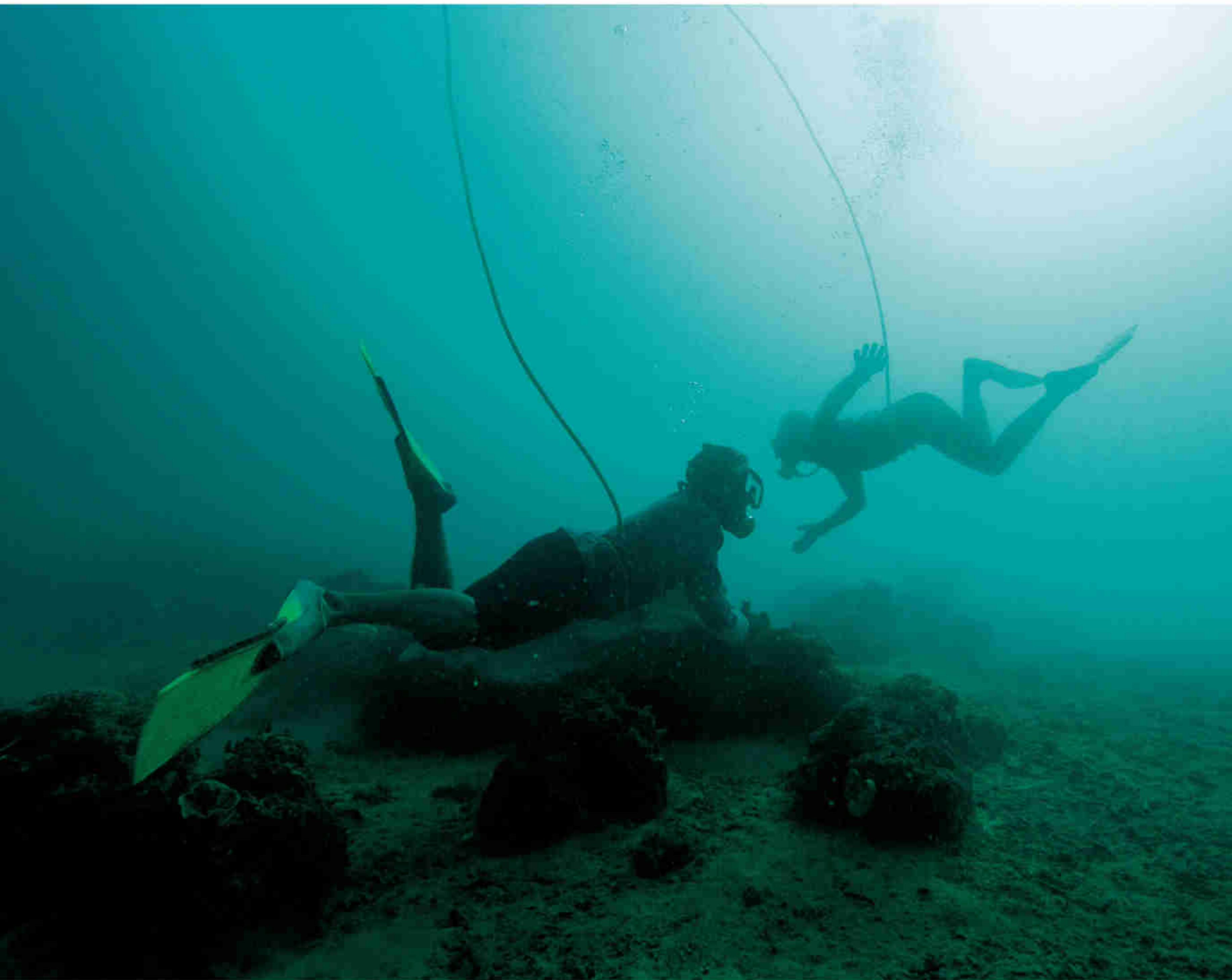
Insatiable Europe

A swordfish is brought ashore in Vigo, Spain, one of the world's busiest seafood ports, handling about 675,000 tons of fish a year. Lower stocks of commercial species such as Atlantic cod and hake have caused a steady decline over the past five years for Spain's fleets, which receive the EU's heaviest subsidies. Yet Spain's—and Europe's—appetite for fish keeps growing. The EU is the world's largest market, taking in 40 percent of all imported fish, with a large chunk coming from developing countries.

Spaniards consume a hundred pounds of seafood a year per person, nearly double the European average and exceeded only by Lithuanians and Portuguese. In northern Spain, the fishing family of María José Novoa Villarejo enjoys mussels and other seafood. Whether her children will choose to make their living through fishing is, for the first time, an open question.



RANDY OLSON (BOTH)



Coral reefs: feeding Asia's fish hunger

A reef off Indonesia—laid bare to supply restaurants with live fish—now attracts divers searching for lobsters, the last remaining valuable species. The global trade in live reef fish may top a billion dollars a year, with many species captured by cyanide or traps. Use of dynamite to kill reef fish increases the toll taken by the live trade. In 2004, the humphead wrasse was the first reef fish listed by the Convention on International Trade in Endangered Species. Live blacktip grouper (not a threatened species) are available in the East Ocean Seafood Restaurant in Guangzhou, China (below). “The taste for fancy, novel, coral reef fish is spreading as wealth is spreading in mainland China,” says Yvonne Sadovy, a biologist at the University of Hong Kong. “Countries must limit export quotas, create protected areas, and encourage consumers to select less threatened species.”



RANDY OLSON (BOTH)





Salted and dried jellyfish have long been considered a delicacy by the Chinese. To fish ecologists, jellyfish may indicate trouble. In some waters where stocks of large fish collapse, jellyfish may proliferate, impeding recovery of stocks by feeding on larvae and eggs and competing for food such as zooplankton.

RANDY OLSON

The greening of the blue

Novel aquaculture methods include deepwater cages supported by pillars operated by Snapperfarm, Inc., off Puerto Rico to grow cobia (right). With this open-ocean system, currents disperse excrement from the fish, but with farms in coastal shallows, waste builds up, polluting the waters. Aquaculture companies usually feed carnivorous fish smaller fish of other species, but Snapperfarm raises its cobia from fingerlings to 12-pound adults in a year on a diet of half grain, half fish meal and hopes eventually to eliminate fish from the feed. Aquaculture now contributes nearly 50 percent of the world's seafood, filling the void left by declining stocks in the wild.

Icelandic fishermen use the open air or geothermal heat to dry some 12,000 tons of cod heads a year for export to Nigeria—an unusual instance of fish protein going to, rather than from, Africa.





BRIAN SKERRY (ABOVE); RANDY OLSON



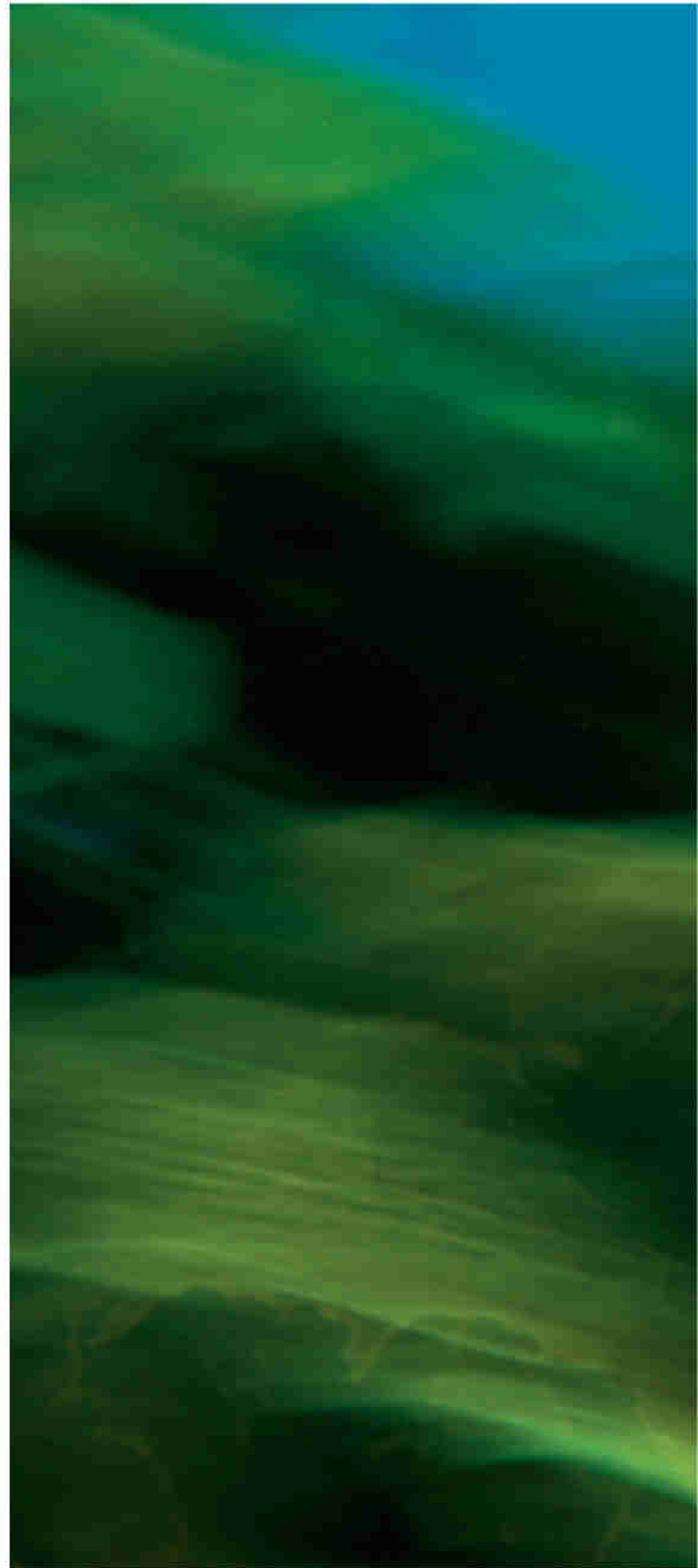
Fish such as Atlantic bumpers are a crucial food source in Senegal and elsewhere in Africa, where 200 million people depend largely on seafood for their animal protein. Worldwide, fish sustain one billion people, many of them poor. As pressure on stocks increases, the challenge for developing countries—whose share of fish production is projected to increase to 81 percent by 2015—is to balance the need for revenue with the need for food. □



New Zealanders embraced a simple idea for restoring their overfished coastal seas: Set aside entire ecosystems for protection. No fishing. No traps. By insisting that nothing be taken, a nation watched its waters surge back to life.

BLUE HAVEN

Undisturbed species like Sandager's wrasse attract sport divers from around the globe to Poor Knights reserve.







Blue maomao round a lush bed of kelp in Poor Knights reserve. Though off-limits to commercial fishing since 1981, the island reserve suffered pressure from recreational fishing until 1998, when full protection was conferred.



Rolling a fresh cigarette, Bill Ballantine gives a sardonic laugh as he recalls the headline when New Zealand's first marine reserve was opened in 1977—"Nothing to do at Goat Island Bay any more." He had fought for 12 years

to protect two square miles of marine habitat on the coast of Northland, a region of the North Island. That protection was finally in place. To Ballantine it was the start of a new era. To the local newspaper, voicing community opposition, it was the end of one.

At issue was the reserve's no-take status. This stretch of sea was to be totally free from human interference. That meant no line fishing. No spearfishing. No hooking a lobster out of its lair. No prying off a clump of rock oysters. No reason, as far as the newspaper was concerned, for any red-blooded, outdoors-loving Kiwi man, woman, or child to bother coming to Goat Island anymore.

Ballantine, 70, a trim man with thinning hair and a stubby white goatee, takes a pull on his cigarette. He sits at the dining table of his cottage on Goat Island Road, half a mile back from the bay. He has lived here since he emigrated from England in 1964 to take up the post of director at the newly opened University of Auckland Marine Laboratory, which stands on a hillside overlooking Goat Island. A mollusk expert, he has been a familiar sight on Goat Island Bay for 40 years, kneeling on the rocky shore to study his beloved limpets.

When he first arrived, the road was a gravel track, as rutted as a washboard. Now it is sealed all the way to the beach to accommodate the constant stream of visitors. "A hundred thousand people a year coming to look at fish—who saw that coming? Nobody," says Ballantine. "Fifteen years ago, if you had suggested that entire school classes would be put into wet suits and taken into the water here you would have been laughed at. Now it's routine."

School field trips by the hundred. Legions of weekend snorkelers. Glass-bottom boat tours for those who prefer to stay dry. A marine

education center. None of it was foreseen, either by the university or the nearby fishing and farming community of Leigh, which was split over the idea from the start.

The battle lines were drawn as early as 1965, when Ballantine invited a group of commercial fishermen to the lab and floated his idea for a reserve closed to fishing. "Half of them said, 'No problem,'" he recalls. "The other half said, only half joking, 'We'll kill you.'"

What eventually transformed public opinion were the changes that happened underwater—changes that took everyone, including Ballantine and his fellow scientists, by surprise. Divers at the marine lab had noticed that large swaths of reef in Goat Island Bay were barren, their seaweed communities grazed to a stubble by a type of sea urchin known by its Maori name *kina*. These underwater lawn mowers, prickly as hedgehogs, had exploded in numbers because their chief predators—snapper and spiny rock lobsters—had been fished down to low levels. *Kina* even climbed up kelp trunks and gnawed through them, like beavers.

When fishing ceased, the imbalance between predators and prey began reversing almost immediately. *Kina* numbers dropped. Kelp grew back. Snapper, once wary and rare, became abundant and fearless. Word of this ecological revival soon spread, and the world beat a path to Goat Island's shore.

For reasons not fully understood, when areas are closed to fishing, snapper aggregate within them, forming large resident populations. Spiny rock lobsters ("crayfish" to New Zealanders) do the same. Their density inside the reserve is about 15 times higher than outside. Commercial crayfishermen have cashed in on the reserve's success because the outward migration of crayfish—a process marine biologists call




Outside the reserve at Five Fingers Peninsula, a fur seal pup in Dusky Sound remains protected, as are all marine mammals in New Zealand's waters.

spillover—brings the crustaceans to their pots, strategically placed just outside the boundary. These former skeptics are now some of the reserve's staunchest defenders. They refer to it as "our reserve" and act as marine minutemen, reporting poachers and boundary cheats.

Spillover and larval export—the drifting of millions of eggs and larvae beyond the reserve—have become central concepts of marine conservation. Reserves where fishing is banned are now seen as potential stud farms and fish hatcheries, replenishing the surrounding seas. Research at Goat Island has provided some of the strongest evidence of this replenishment effect—research made possible by the fact that the reserve has been closed to fishing for 30 years.

Goat Island was revolutionary not just because it was one of the world's first no-take reserves, but also because it protected an ordinary stretch of coastline. In true Kiwi egalitarian spirit, the legislation enacted in 1971 to create reserves declared that its purpose was to preserve the typical as well as the unique, and that such preservation was in the national interest. Located in the middle of the water hemisphere, with a coastline greater in length than that of the contiguous U.S. and the world's fourth largest EEZ (the exclusive economic zone recognized by the UN), New Zealand is indisputably one of the most maritime nations on Earth. The country had been a world leader in developing land reserves; now it was time to do the same for the sea.

An aerial photograph of a river system. The water is a deep, dark brownish-green color, indicating high tannin content. The river flows through a dense, lush green forest. The riverbed is visible in some areas, showing light-colored sand and gravel. The surrounding landscape is a mix of forest and open areas with low vegetation.

River water stained by tannins from leaf litter flows from the peaks of Fiordland National Park into Gaer Arm reserve. The dark waters provide shade for a menagerie of creatures normally found in far deeper waters.



Despite the recent gains, only 0.01 percent of the world's oceans

Given the success of Goat Island, one might assume that the rollout of further marine reserves would have been rapid and decisive. It wasn't. For the next three decades Ballantine would square off against stubborn anglers, reluctant bureaucrats, and fence-sitting scientists.

There was a setback with the very next reserve application, over the Poor Knights Islands, 12 nautical miles off the Northland coast. Remnants of an ancient volcano, this cluster of reefs and pinnacles lies at an intersection between temperate and subtropical waters. A warm current originating hundreds of miles to the northwest sweeps past the islands, raising the water temperature one degree higher than on the coast and bringing with it a host of tropical visitors, from coral shrimps to whale sharks.

The underwater architecture is as striking as the marine life. Millions of years of weathering have riddled the islands with arches, tunnels, and caves. The walls of one arch drop 150 feet from surface to seabed, completely drenched in living color. At times, squadrons of 60 or more stingrays hover like stacks of flying saucers in this ethereal blue keyhole.

A submarine cave on the exposed eastern side holds a permanent air pocket trapped against its ceiling. Divers enter through a portal 40 feet under the surface and swim up into the bubble, which is the size of a small car. It is a wonderfully incongruous feeling to take out your scuba mouthpiece 20 feet under the sea and breathe deep drafts of moist, salty, subterranean air.

Rated one of the world's top subtropical dive sites, the Poor Knights would seem to have been the perfect candidate for reserve protection. Yet astonishingly, the legislation crafted to protect such habitats was amended to downgrade that protection. Pressure from recreational fishing interests was the reason. The islands were a favorite destination for anglers and supported a strong game-fishing fleet. Anglers strenuously objected to having such prized fishing grounds declared off-limits. And so began what Ballantine calls the grand compromise, in which commercial fishing was banned but recreational fishing for the most popular species was permitted.

To Ballantine it was a travesty. The act of

parliament that sanctified ordinary Goat Island now denied the iconic Poor Knights its chance for ecological redemption. Seventeen years of jousting would elapse before the recreational-fishing provision was removed and full protection was conferred on the beleaguered Knights.

To be fair, few realized the extent to which recreational fishing can damage marine ecosystems. Commercial fishing, with its capacity to scoop up whole schools in a single trawl, or deploy thousands of hooks in a night, was perceived to be the enemy, not a bunch of weekend anglers trying to catch a feed. Only later, as fish numbers dwindled and some species became rare, was the scale of the problem realized.

A curious thing happens when fish stocks decline: People who aren't aware of the old levels accept the new ones as normal. Over generations, societies adjust their expectations downward to match prevailing conditions. The concept of a healthy ocean drifts from greater to lesser abundance, richer to poorer biodiversity.

For those who live through the changes, who witness the emaciation of the sea at firsthand, it is a dispiriting experience. "I take visitors out to the Poor Knights today, and they're so excited by the fish life they're just about walking on water," says Wade Doak, one of the country's pioneer divers and underwater naturalists. "And all I can think is that they're seeing a crumb, a skerrick of what it once was."

Marine reserves are an antidote to this collective amnesia. They provide a scientific benchmark against which changes in the wider ocean—the exploited ocean—can be measured. "If nothing is left intact or pristine, how can you know that damage has occurred?" Ballantine asks. Indeed, how do you even imagine an undamaged state?

Seen in this light, marine reserves are the reference collections of the sea, or, as Doak likes to call them, "wet libraries." Like libraries on land, they should be regarded as essential public amenities. And, as the Poor Knights experience shows, they must be fully protected. Allowing fishing in a marine reserve makes as much sense as allowing the most popular books in the library to be borrowed and never returned.

are closed to fishing.

Doak dreams of the day when establishing marine reserves becomes as automatic as building a school in a new residential area, or opening a medical clinic, or planting a park.

We're not there yet. So far, the acquisition of most reserves in New Zealand has been a slow and contentious business involving the voluntary effort of community groups, dive clubs, conservation organizations, Maori communities, and even a group of high school students.

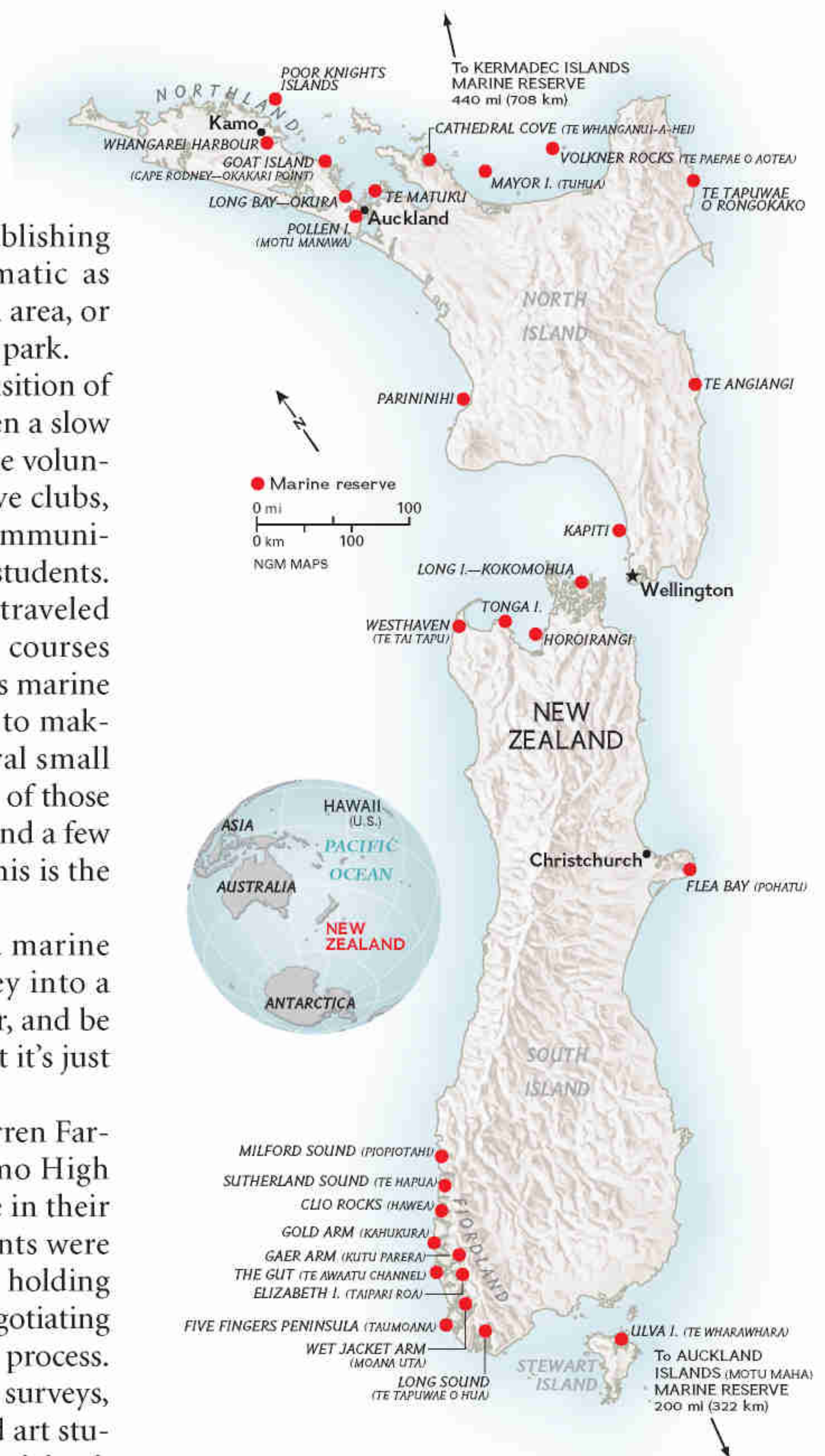
During the late 1980s, Ballantine traveled the country holding adult education courses for anyone interested. "The subject was marine studies, but everything was oriented to making marine reserves," he says. "Several small groups sprang up as a result, and some of those groups went on to propose reserves, and a few of those proposals were successful. This is the way it has been."

Ballantine likens the creation of a marine reserve to a drunk trying to get a key into a lock: "You have to be at the right door, and be holding the right key, but beyond that it's just persistence."

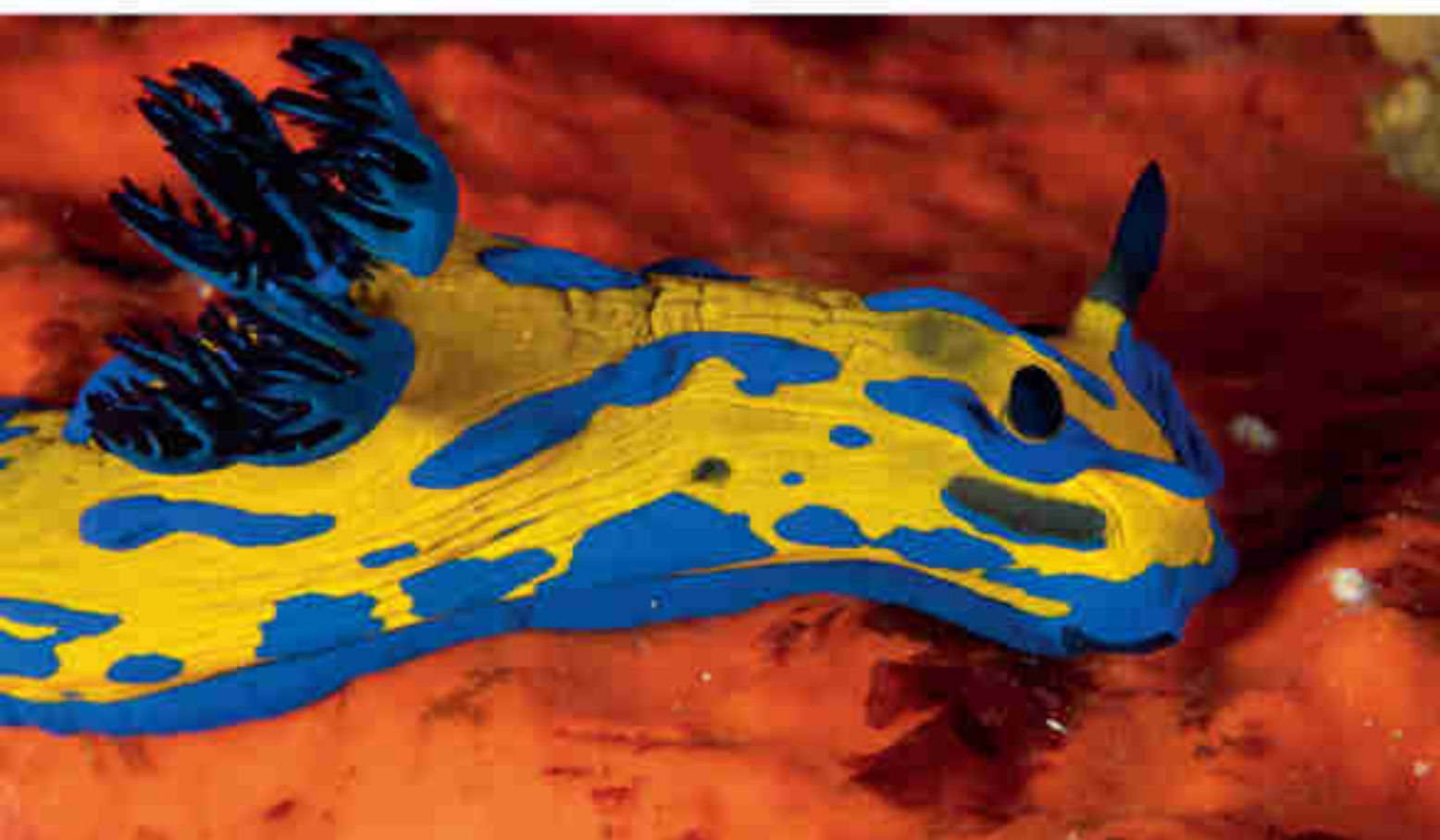
It took 14 years for students of Warren Farrelly's senior geography class at Kamo High School, in Northland, to get a reserve in their local harbor. Over a thousand students were involved, deciding on the boundaries, holding public meetings, raising funds, and negotiating the twists and turns of the application process. Math classes analyzed public-opinion surveys, media classes wrote press releases, and art students produced illustrations for a children's book on marine reserves. Each graduating class passed the torch, and in 2005 Whangarei Harbour Marine Reserve became a reality.

Farrelly, retired now but still a keen diver and underwater photographer, is proud of what was achieved by his students—some of whom, he says, "had never even stuck their heads in the water before." Several have gone on to pursue marine or environmental studies at university.

Samara Sutherland, class of '98, co-founded a program called Experiencing Marine Reserves, an initiative that has won her several leadership awards. At a summer snorkeling day in the newly opened reserve, she stood in the shallow



When New Zealand's first marine reserve was proposed in 1965, at Goat Island, some local folks screamed in protest. But after many battles most New Zealanders now value reserves for promoting education, recreation, and tourism, as well as conservation. The nation has 31 such havens, with more in the planning stage. The goal: to set aside 10 percent of coastal waters by 2010.



Reserve status protects creatures as small as this fanciful sea slug foraging in the Poor Knights Islands.

water giving instructions to excited children decked out with zingy wet suits, dive masks, and flutterboards. She sent them off like ducklings, half a dozen trailing a parent, to the nearby reefs, where leatherjackets, seahorses, and anemones awaited discovery. They dipped their faces underwater, popped up, and squealed, “I saw a fish! I saw a fish!”

Yet this brand new library of the sea is only half its intended size. The application sought protection for three sites, but only two were approved. The site most popular with anglers—the largest of the three—was removed from consideration at the 11th hour by conservation officials with no stomach for a fight.

For the students, it was a bitter lesson in political expediency and a reminder of the strength of the anti-reserve lobby. New Zealand may have led the world in creating no-take reserves, but many of its citizens continue to resent their existence and dispute their worth.

Not so the commercial crayfishermen of Fiordland, a wilderness in southwestern New Zealand, who voluntarily vacated prime lobster-fishing waters and instigated the creation of a network of protected areas. Ten no-take reserves and five no-anchoring areas now preserve underwater communities so vulnerable to damage that scientists have dubbed them “china shops.”

Many of the treasures found in these sites are there due to a stroke of hydrological serendipity. Tannin-stained fresh water flowing into the

fiords from rain forests forms a light-blocking layer several feet thick that floats on the denser seawater. The presence of this layer allows normally light-shy species such as black coral, lampshells, and sea pens, a type of soft coral, to live at much shallower depths than usual.

Descending into the fiords is like landing through smog in an aircraft. For a few seconds everything is brown, and you’re diving blind. Then, at the mixing point between fresh and salt, the water starts to shimmer like a mirage, and you emerge like Alice through the looking glass. Projecting from the fiord walls are ten-foot-tall black coral trees. Butterfly perch shoal among their branches like Christmas tree ornaments. Symbiotic snake stars—sulfur yellow, burgundy, spotted, or boldly striped—entwine their arms tightly around twig and trunk.

Wax ascidians—sponge-like encrustations—drip down the rock faces like melting candles. A pea green sea slug the size of a grapefruit rests in corpulent splendor on a boulder. At a site called Strawberry Fields, pimply, red sea squirts turn the rocks into an underwater fruit bowl. Arrays of sea pens stand on the seabed like some kind of alien installation. Cruising them are nosy, in-your-face blue cod, wearing perpetual frowns on their frog-eyed noggins.

Longtime crayfisherman turned eco-cruise operator Lance Shaw shudders when he thinks of the damage the steel pots did as they were lowered down the walls, crushing whatever was in their path until they landed on a suitable ledge. “When I started diving and saw what was living on the walls, I thought, What have we done?”

Fiordland’s reserves and a handful of others have brought New Zealand’s tally of no-take areas to 31, covering nearly 8 percent of the country’s coastal waters. Yet 99 percent of this protected habitat lies within just two reserves, each hundreds of miles from the mainland, and the smallest of the country’s 14 terrestrial national parks protects an area greater than all the coastal marine reserves combined.

Yes, New Zealand has led the world in marine protection, says Ballantine, but what is there to cheer about “if you’re leading in a race of arthritic tortoises?”

What Ballantine is arguing for is nothing less than a new ocean ethic.

Lately, there have been signs of progress in other parts of the ocean. Several huge protection zones have been created in the past five years, culminating in the opening in 2006 of the Northwestern Hawaiian Islands Marine National Monument—a Montana-size chunk of ocean touted as the largest marine protected area in the world.

Even more important than the creation of separate reserves has been the establishment of protected-area networks—combinations of no-take areas spaced to maximize their potential in replenishing the surrounding seas. Designing such networks is one of the fastest growing disciplines in marine conservation today. The idea is to protect representative portions of all marine habitats and ecosystems in all biogeographic regions, creating “blue oases” of sustainability throughout the ocean.

One such network was recently put in place in Australia’s Great Barrier Reef Marine Park, increasing the area under no-take protection from 4.5 to 33 percent, with reserves covering some 70 bioregions. California just established a network of 29 reserves—half of which ban all fishing—along its central coast, covering nearly 200 square miles of state waters from Santa Barbara to Santa Cruz. The state plans to set up reserves along its entire coastline by 2011.

Another positive development has been the extension of marine protection to the open ocean. New Zealand’s billion-dollar fishing industry recently proposed that 30 percent of the country’s EEZ be set aside. Dredging and bottom trawling would be prohibited in these areas, in recognition of the destructiveness of these forms of fishing. (Scraping the seabed to catch fish has been compared to clear-cutting the forest to catch deer.) Nearly half of New Zealand’s 250 seamounts—undersea islands that are likely bristling with undiscovered species—would gain some protection under this proposal.

Despite the recent gains, only 0.01 percent of the world’s oceans are closed to fishing. This is not just a problem for conservation; it is a problem for fisheries. Many fisheries scientists now say that traditional management techniques are incapable of achieving sustainable fisheries, and that ecosystem restoration is the only way to

prevent the widespread collapse of fish stocks. The World Wildlife Fund has called for 20 percent no-take protection of the world’s oceans by 2020. Some scientists have gone even further, suggesting that 40 or 50 percent closures may be necessary to prevent the commercial extinction of some species.

Bill Ballantine himself is wary of using fisheries goals as the main reason for establishing reserves. Yes, marine reserves can improve fisheries yields. Yes, they provide tourism and recreation opportunities, educate the public, and expand scientific knowledge. But these utilitarian benefits are secondary, he says. The fundamental purpose of marine protection should be to restore ecosystems and rebuild biodiversity.

What Ballantine is arguing for is nothing less than a new ocean ethic, in which the ocean is seen not as a commodity we own but as a community of which we are a part. It’s a simple message: The sea is worth saving for its own sake.

Ballantine’s insistence on no-take reserves as the means to that end has made him a thorn in the side of anglers, politicians, and even some of his professional colleagues. There was a day, late in the Goat Island saga, when the country’s attorney general paid him a visit and spent six hours trying to persuade him to capitulate over his no-take stance. After his guest had left, Ballantine went up to see the farmer on whose land the marine laboratory had been built, to ask him whether he thought he was doing the right thing. Roddy Matheson had lived most of his life overlooking Goat Island. He remembered when crayfish in the bay were so abundant you could pick them out of the rock pools.

“Roddy was never one for a quick answer,” Ballantine says, “so we had a cup of tea, discussed the grass growth, and rolled a cigarette or two. But as I got up to leave, he said, ‘You know, it used to be quite different round here. I would like my grandchildren to see what it was like then.’ That was all he said—but on the strength of that I fought them tooth and nail.”

➤ **Blue Oases** See Web-exclusive photos of New Zealand’s marine protected areas and read field notes from the author at ngm.com/0704.



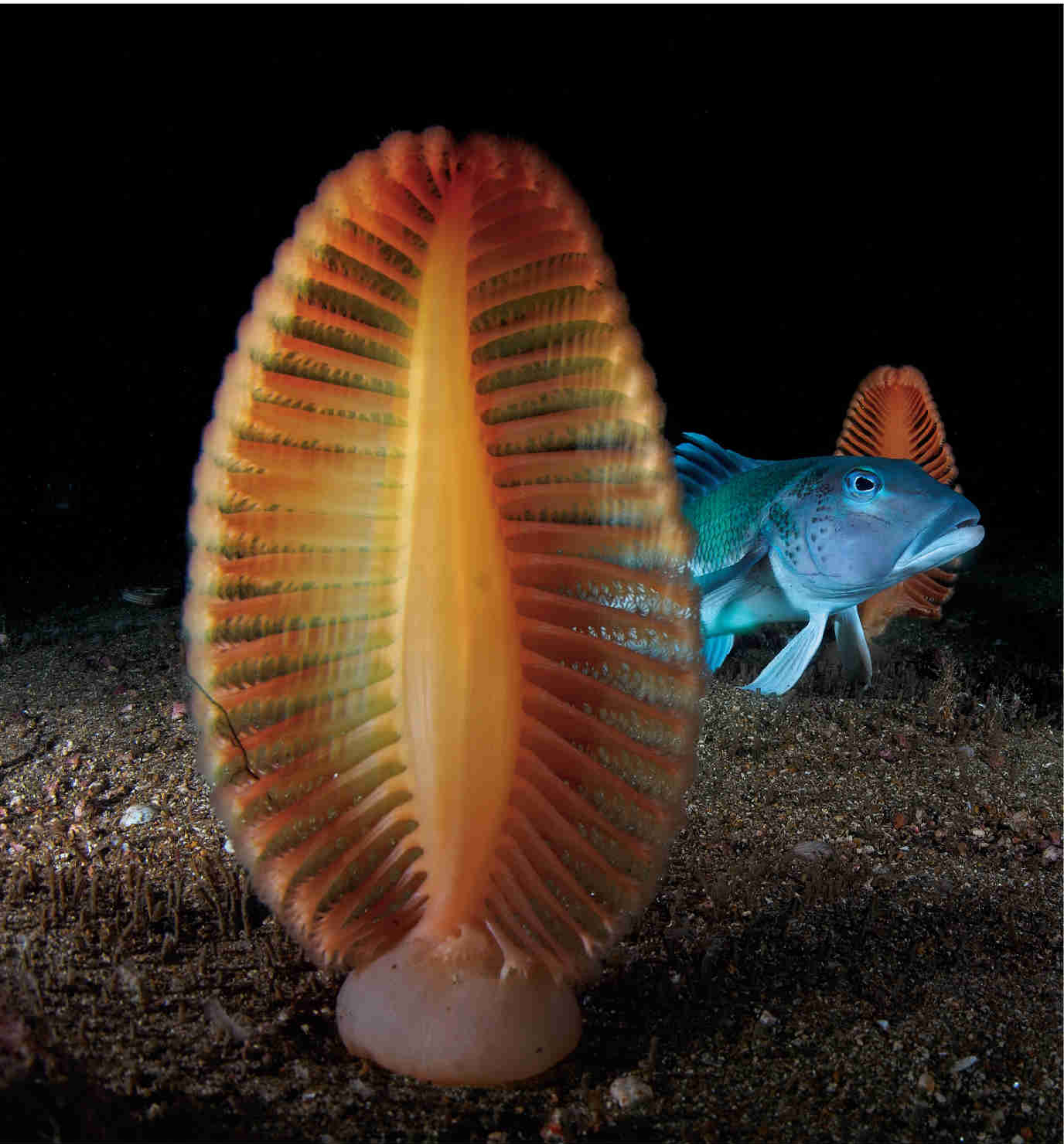
A short-tailed stingray rides the currents through arches and caverns at Poor Knights. New Zealand, praised as a world leader in marine protection, considers the ecological preservation of such seascapes to be in its national interest.





Restoring balance between predator and prey, once overfished snapper eat sea urchins that had nearly denuded the reefs at Goat Island reserve (top right). A blue-eyed triplefin (above), small as a matchstick, guards its territory with an aggressive pose. Waiting for a meal, a moray eel hides in a sponge.







Soft corals called sea pens, usually found at depth, and a blue cod appear in shallow waters in Long Sound reserve, where tannin-stained water blocks light. When disturbed, sea pens emit a greenish light and can deflate, retreating into their bulbous feet.



A dense forest of black coral with yellowish-green branches against a dark blue background. The coral branches are intricate and feathery, creating a complex, textured appearance. The lighting is soft, highlighting the delicate structure of the coral against the deep blue water.

A forest of black coral, which can live 300 years, grows in Wet Jacket Arm reserve. New Zealand's reserves offer a benchmark of such wonders, a way to gauge change in the oceans, says Bill Ballantine, a biologist who champions reserves. "We could learn what was natural, instead of just imagining it." □



3 | **GLOBAL FISH CRISIS**

Cod from Newfoundland fed the world for centuries. By the 1990s, industrial fishing had destroyed the stocks. On the island's southwest coast, an isolated community struggles to survive the collapse of the resource that sustained it.

END OF THE LINE

Fog lies thick on the harbor as Ray Vautier, whose family has lived in the village of La Poile for generations, nets baitfish.



The story of how the Vautiers began generations ago to make a living pulling cod from the waters off Newfoundland, hefting each sleek green-and-white fish by hand as it came off the line, is lost in family history. But how it all will end is perfectly clear.

Ray Vautier is trying to sell his boat, and when he succeeds, all the uncanny skills repeatedly passed from father to son—the ability to read the surface of the water, to know each crevasse and outcropping of the bottom, and most of all to sense where fish are lurking—will die in his family. Vautier, 45, prepared for this when he sent his son to college in St. John's to study automotive technology.

What keeps him on the water for now is the glut of fishing craft going on the market as small-scale harvesters around Newfoundland abandon the industry that once defined the province. So far, no one has made a decent offer on the 35-foot fiberglass-hulled diesel Vautier bought new in 2003, at last realizing a goal he'd held since he started fishing as a teenager. "I'd always wanted a new boat, something solid with no leaks," he says. "Looks like I picked a poor time to get her." Scant months after his purchase, Canadian officials declared a moratorium on all cod fishing, the second time in a decade they closed fishing grounds because of overharvesting. Cod fishing became legal again the following year, but with catch limits so small and strictly enforced that Vautier has finally accepted that he can't make a living aboard the boat he christened *Awaited Dream*.

It's chilly, and a mist is falling at 3 a.m. on opening day of the 2006 cod season, fine weather by a fisherman's standards. Vautier leaves his house and trudges along a darkened footpath that runs the length of La Poile. The village is what Newfoundlanders call an outport community. No roads reach it; no car has ever driven here. Since people began settling here in the 19th century, coming and going has meant taking a boat, and fishing has been about the only economic activity. Tidy, wood-frame houses built on granite outcroppings rise in tiers above a protected harbor that opens into La Poile Bay, a beautiful fiord-like expanse of salt water that pierces about ten miles inland. The village is peaceful, its setting idyllic, but it is dying. The young people, no longer able to make a living fishing, are forced to leave to find work. Again and again I meet people in La Poile who cite the elementary school as an indicator of doom: A generation ago it enrolled about 80 children; last school year there were eight. *(Continued on page 96)*





A fish shack on La Poile's wharf does double duty: Jonathon Organ works on a line while his friends pursue teenage pastimes. During summer, La Poile is awash in high schoolers, but come fall they'll return to studies in distant towns. Few, if any, of the current crop of teens plan to follow their fathers into commercial fishing.





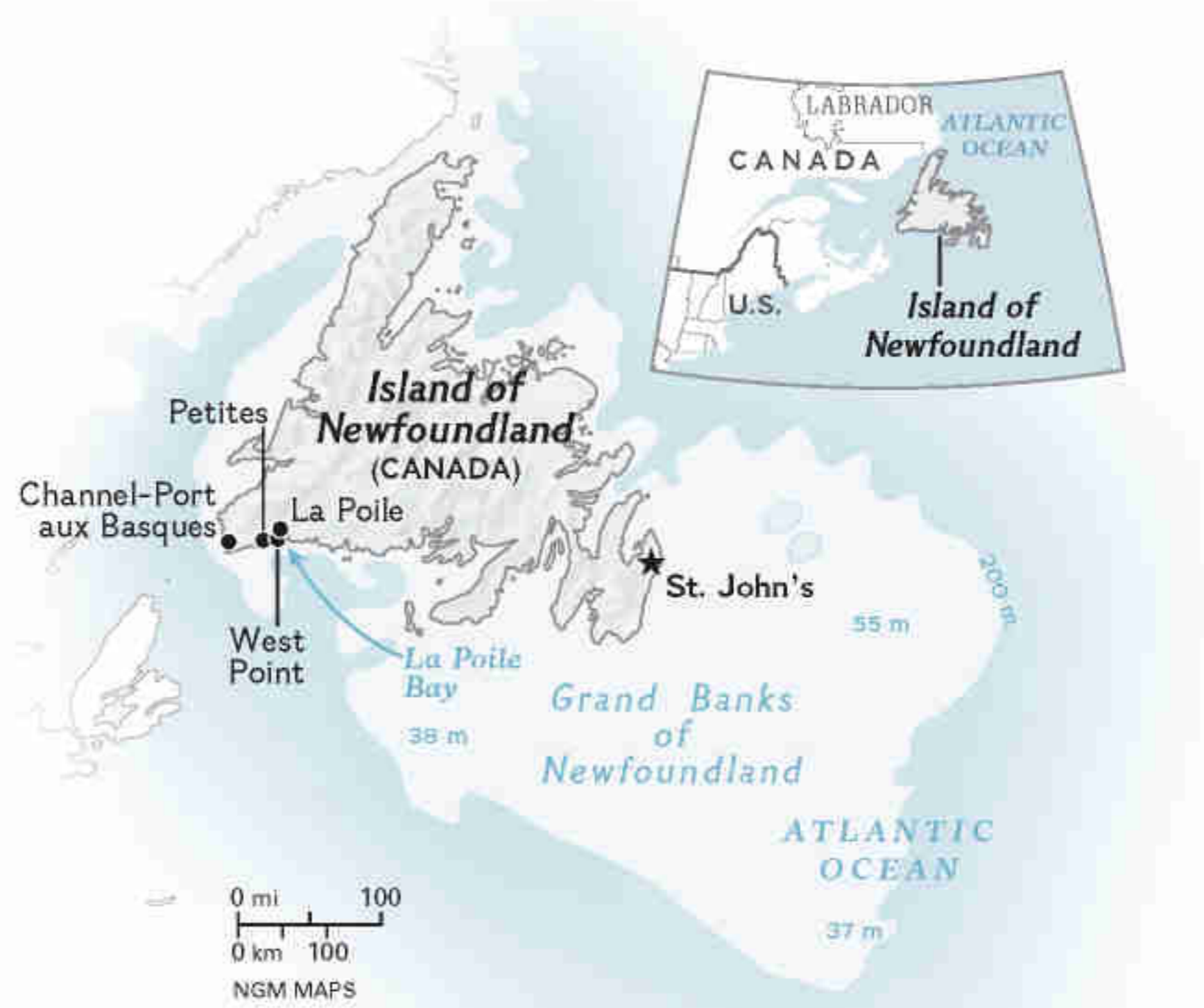
Weathered rock, a leaden sky, and the amber waters of the bay frame tiny La Poile (above). The village is home to just over a hundred residents, including Lloyd Vautier (bottom left), taking in fresh air from his window on a fair day. Ancestors of current residents began settling here in the 1800s, when cod were so bountiful that, as the saying goes, you could step out of your boat and walk to shore on their backs. No more. Strict limits on catches, imposed since the collapse of Atlantic cod stocks, are pushing many harvesters out of commercial fishing. Some are lucky enough to be licensed to catch lobsters (top left) to supplement declining incomes.

The boats of several other La Poile fishermen are already gone when Vautier reaches the brightly lit wharf, where he's joined by his lone crewman, Alvin Bond. At 38, Bond has been working on fishing boats for years but doesn't hold a commercial license himself. Recent regulations don't allow his semi-retired father to pass down his license, and Bond doesn't have the tens of thousands of dollars he'd need to buy a license from another fisherman. These days, he says bitterly, banks aren't eager to lend money to someone trying to start a fishing operation.

Soon the *Awaited Dream* is chugging in the darkness through the bay toward the open sea. As the swell increases, Bond braces himself and prepares the longline La Poile fishermen have traditionally used to catch fish. Inside several barrels is about two miles of heavy line with 2,000 herring-baited hooks dangling from it. The line will sink to the bottom, where cod live and feed, and in a few hours the harvesters will return to haul in the catch.

Not long ago, Bond says, fishermen could put out as many hooks on as much line as their boat could accommodate. Now, the government has limited the number of hooks to 2,000 to prevent overfishing, as well as limiting the cod season to only a few weeks a year. Bond believes that in the fishing grounds near La Poile, at least, the fish have recovered and fisheries managers are trumping up the crisis. "The government's hired a lot of scientists since the fishery shut down, and they all know that after fishing comes back, a lot of them are going to be laid off."

While such open accusations of bad faith are rare in La Poile, at least to an outsider, every working fisherman I spoke with here believes the fisheries crisis has been overstated—that there are far more cod than the government lets on. "I can't see any shortage of cod at all," says Peter Francis, a so-called sentinel fisherman, who is paid to fish several months a year for government researchers. He measures and weighs the catch, and from some fish removes a bone, the otolith, from the inner ear. By examining growth layers in the bone, a scientist will determine the fish's age. During cod season Francis also fishes on his own commercial license. He has a third job three months a year working thousands of miles away in the oil fields of western Canada, as do an increasing number of men from La Poile. It's the dangerous but well-paid oil work that provides the biggest part of the family budget.





Gulls hungry for a scrap of bait shadow Peter Francis, who fishes for government scientists tracking the state of cod stocks. Francis believes the fish have recovered enough to allow a larger catch and a better living for fishermen.

A few days before the season opened, I had gone with Francis as he set his line on the far side of La Poile Bay. Two hours later he fired up his hydraulic-powered “hauler,” and soon fish were coming up over the side. There were stretches of line where every hook seemed to hold a fish, and Francis threw them into fast-filling tubs in the center of the boat. In all, he brought in about 1,600 pounds of cod. “That’s very good fishing—good as it ever was, probably,” he said. But to scientists who look at fish stocks on a broad scale, the absence of cod is apparent in ways not obvious to local fishermen, says George Rose, a fisheries expert at the Marine Institute in St. John’s.

“Where the rebuilding of stocks has taken place, it’s a patchwork quilt,” says Rose. “Even on the northeast coast, where depletion is worst, I could take you to places with as many fish as there ever were in history. The problem is that there used to be this abundance along hundreds and hundreds of miles of coast, and now it’s in isolated spots.”

Far offshore, on the Grand Banks of Newfoundland and off the Labrador coast, the great historic stocks of cod—the valuable natural resource that first lured Europeans to Newfoundland 500 years ago—are gone. Those fish were taken out by massive factory trawlers that appeared after the Second

World War, pulling up millions of tons of fish, dragging the bottom, and tearing up breeding habitat. Near La Poile in southwestern Newfoundland, smaller draggers had the same effect on local stocks, Rose says. Destructive though it may be, dragging is the only catch method used in lucrative Newfoundland fisheries such as shrimp, so it won't disappear anytime soon. Fishermen and scientists alike acknowledge that if cod quotas were significantly loosened, the draggers would quickly return to scrape the sea clean in places cod are now struggling to make a comeback.

The sad irony is that La Poile's hook-and-line fishery is actually the right way to fish, Rose says. If all fishing over the past 40 years had been with this method, spawning grounds would still be intact, fish would be plentiful, and the current cod crisis wouldn't exist.

It's now around noon on opening day, and boats are returning to the harbor with the first catch of the season. Vautier and Bond, like most others, are carrying roughly half the weekly quota of 3,600 pounds. They'll go back for the rest tomorrow. The star of the day is Winston Organ, a hulking, black-bearded fisherman who's brought in his entire week's catch in one morning of work. As he waits in his boat for his turn at the unloading crane, he turns up his sound system and Newfoundland country music, mournful and Irish-tinged, floats over the water. The singer is lamenting the death of a way of life as families that formerly relied on fishing migrate elsewhere to find work. "It's sad but it's true, there be no one to welcome you home."

The song has the feel of a documentary. Just a few miles from here, empty houses stand in abandoned fishing settlements like West Point and Petites. The people of La Poile pass these ghostly places every time they take the ferry in or out. Many of them predict the same fate for their own community in a decade or two, now that the cod are gone or—depending on whose word you believe—just off-limits.

But the song and the pall it casts mean nothing to one person on the wharf today. Seven-year-old Cody Chant sits on his bike in the middle of the dock utterly delighted by the bustle revving up around him as more boats come in—the splat of 500 pounds of cod landing on the cleaning table, the flying fish guts, the forklift dashing back and forth with crates of ice.

"I loves fishing," he proclaims, his accent evoking the speech of settlers from England and Ireland who were drawn here centuries ago by the cod. "I'm going to be a fisherman when I grow up," he says. "I'm gonna have my own boat." □



▲ **Dream and Reality** Documenting a vanishing way of life is a bittersweet experience, says author Chris Carroll. Read his reflections at ngm.com/0704.

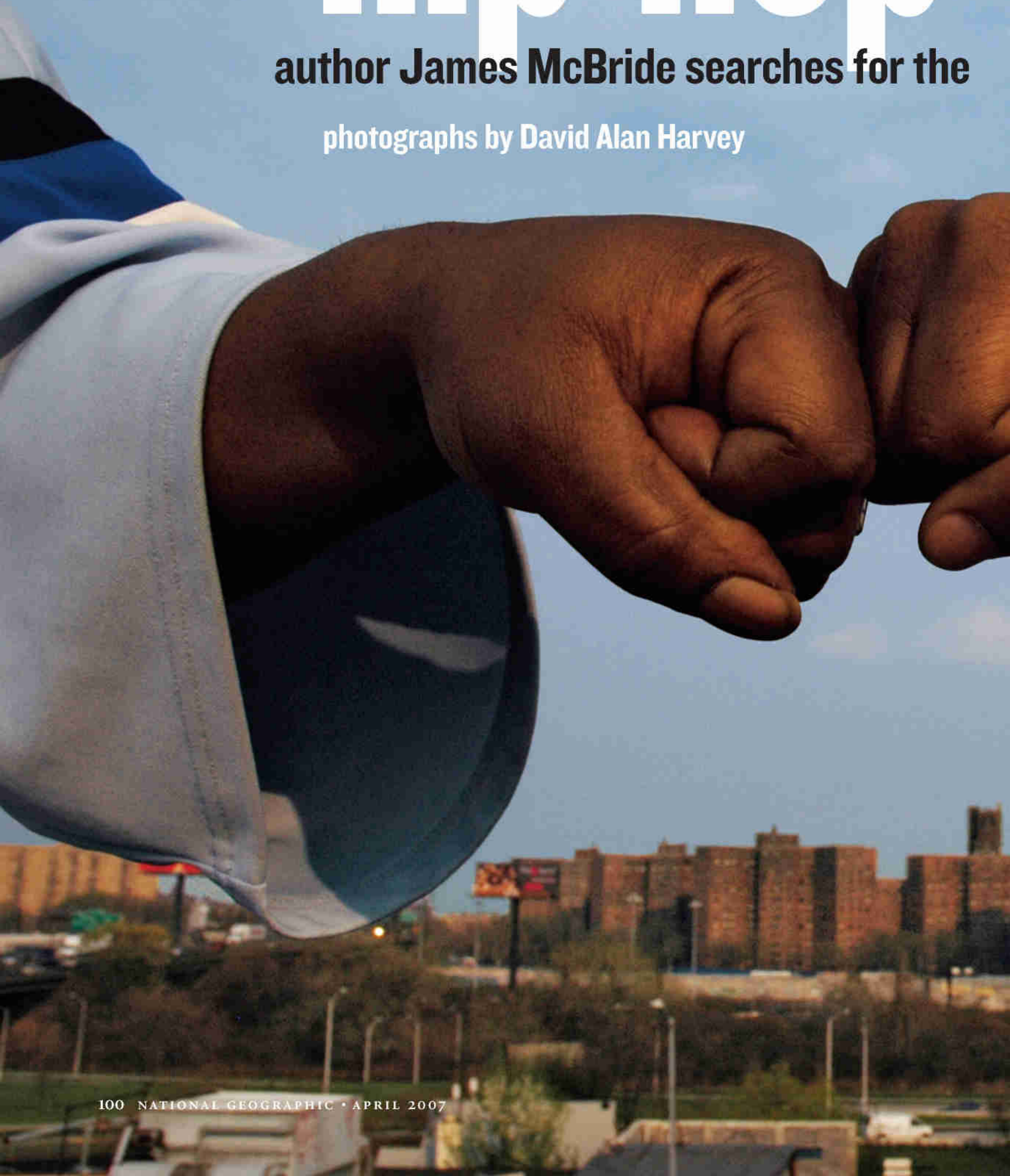


A boy warms himself on a chilly bay shore. Though still idyllic places to grow up, the traditional communities that long relied on cod offer little future for the young. Unable to fish, they increasingly scatter across Canada and beyond to find work.

hip-hop

author **James McBride** searches for the

photographs by **David Alan Harvey**



planet

roots of the music that can't be ignored

THE BRONX Two aspiring rap artists join fists near their home in the Bronx River Houses, one of the New York City public housing projects where the world-conquering mélange of music, dance, and graffiti known as hip-hop was born in the 1970s.



AFRICA Traditional drumming propels a newborn's welcoming ceremony in the Casamance region of Senegal. Powerful West African rhythms survived the slave trade and continue to pulse in the lands of the African diaspora, laying a foundation for many popular music forms: jazz, salsa, rock, hip-hop.





New York hip-hoppers don flashy bling as a show of style and status.

This is my nightmare: *My daughter comes home with a guy and says, “Dad, we’re getting married.” And he’s a rapper, with a mouthful of gold teeth, a do-rag on his head, muscles popping out his arms, and a thug attitude. And then the nightmare gets deeper, because before you know it, I’m hearing the pitter-patter of little feet, their offspring, cascading through my living room, cascading through my life, drowning me with the sound of my own hypocrisy, because when I was young, I was a knucklehead, too, hearing my own music, my own sounds. And so I curse the day I saw his face, which is a reflection of my own, and I rue the day I heard his name, because I realize to my horror that rap—music seemingly without melody, sensibility, instruments, verse, or harmony, music with no beginning, end, or middle, music that doesn’t even seem to be music—rules the world. It is no longer my world. It is his world. And I live in it. I live on a hip-hop planet.*

High-stepping

I remember when I first heard rap. I was standing in the kitchen at a party in Harlem. It was 1980. A friend of mine named Bill had just gone on the blink. He slapped a guy, a total stranger, in the face right in front of me. I can’t remember why. Bill was a fellow student. He was short-circuiting. Problem was, the guy he slapped was a big guy, a dude wearing a do-rag who’d crashed the party with three friends, and, judging by the fury on their faces, there would be no Martin

Luther King moments in our immediate future.

There were no white people in the room, though I confess I wished there had been, if only to hide the paleness of my own frightened face. We were black and Latino students about to graduate from Columbia University’s journalism school, having learned the whos, whats, wheres, whens, and whys of American reporting. But the real storytellers of the American experience came from the world of the guy that

Bill had just slapped. They lived less than a mile from us in the South Bronx. They had no journalism degrees. No money. No credibility. What they did have, however, was talent.

Earlier that night, somebody tossed a record on the turntable, which sent my fellow students stumbling onto the dance floor, howling with delight, and made me, a jazz lover, cringe. It sounded like a broken record. It was a version of an old hit record called “Good Times,” the same four bars looped over and over. And on top of this loop, a kid spouted a rhyme about how he was the best disc jockey in the world. It was called “Rapper’s Delight.” I thought it was the most ridiculous thing I’d ever heard. More ridiculous than Bill slapping that stranger.

Bill survived that evening, but in many ways, I did not. For the next 26 years, I high-stepped past that music the way you step over a crack in the sidewalk. I heard it pounding out of cars and alleyways from Paris to Abidjan, yet I never listened. It came rumbling out of boomboxes from Johannesburg to Osaka, yet I pretended not to hear. I must have strolled past the corner of St. James Place and Fulton Street in my native Brooklyn where a fat kid named Christopher Wallace, aka Biggie Smalls, stood amusing his friends with rhyme, a hundred times, yet I barely noticed. I high-stepped away from that music for 26 years because it was everything I thought it was, and more than I ever dreamed it would be, but mostly, because it held everything I wanted to leave behind.

In doing so, I missed the most important cultural event in my lifetime.

Not since the advent of swing jazz in the 1930s has an American music exploded across the world with such overwhelming force. Not since the Beatles invaded America and Elvis packed up his blue suede shoes has a music crashed against the world with such outrage. This defiant culture of song, graffiti, and dance, collectively known as hip-hop, has ripped popular music from its moorings in every society it has permeated. In Brazil, rap rivals samba in popularity. In China, teens spray-paint graffiti on the Great Wall. In France it has been blamed, unfairly, for the worst civil unrest that country has seen in decades.

Its structure is unique, complex, and at times bewildering. Whatever music it eats becomes part of its vocabulary, and as the commercial

world falls into place behind it to gobble up the powerful slop in its wake, it metamorphoses into the Next Big Thing. It is a music that defies definition, yet defines our collective societies in immeasurable ways. To many of my generation, despite all attempts to exploit it, belittle it, numb it, classify it, and analyze it, hip-hop remains an enigma, a clarion call, a cry of “I am” from the youth of the world. We’d be wise, I suppose, to start paying attention.

Burning Man

Imagine a burning man. He is on fire. He runs into the room. You put out the flames. Then another burning man arrives. You put him out and go about your business. Then two, three, four, five, ten appear. You extinguish them all, send them to the hospital. Then imagine no one bothers to examine why the men caught fire in the first place. That is the story of hip-hop.

It is a music dipped in the boiling cauldron of race and class, and for that reason it is clouded with mystics, snake oil salesmen, two-bit scholars, race-baiters, and sneaker salesmen, all professing to know the facts, to be “real,” when the reality of race is like shifting sand, dependent on time, place, circumstance, and who’s telling the history. Here’s the real story: In the mid-1970s, New York City was nearly broke. The public school system cut funding for the arts drastically. Gone were the days when you could wander into the band room, rent a clarinet for a minimal fee, and march it home to squeal on it and drive your parents nuts.

The kids of the South Bronx and Harlem came up with something else. In the summer of 1973, at 1595 East 174th Street in the Bronx River Houses, a black teenager named Afrika Bambaataa stuck a speaker in his mother’s first-floor living room window, ran a wire to the turntable in his bedroom, and set the housing project of 3,000 people alight with party music. At the same time, a Jamaican teenager named Kool DJ Herc was starting up the scene in the East Bronx, while a technical whiz named Grandmaster Flash was rising to prominence a

James McBride, a journalist and jazz musician, is the best-selling author of The Color of Water, an autobiography that explores race and identity in America.

couple of miles south. The Bronx became a music magnet for Puerto Ricans, Jamaicans, Dominicans, and black Americans from the surrounding areas. Fab 5 Freddy, Kurtis Blow, and Melle Mel were only a few of the pioneers. Grand Wizard Theodore, Kool DJ AJ, the Cold Crush Brothers, Spoony Gee, and the Rock Steady Crew of B-boys showed up to “battle”—dance, trade quips and rhymes, check out each other’s records and equipment—not knowing as they strolled through the doors of the community center near Bambaataa’s mother’s apartment that they were writing musical history. Among them was an MC named Lovebug Starski, who was said to utter the phrase “hip-hop” between breaks to keep time.

This is how it worked: One guy, the DJ, played records on two turntables. One guy—or girl—served as master of ceremonies, or MC. The DJs learned to move the record back and forth under the needle to create a “scratch,” or to drop the needle on the record where the beat was the hottest, playing “the break” over and over to keep the folks dancing. The MCs “rapped” over the music to keep the party going. One MC sought to outchat the other. Dance styles were created—“locking” and “popping” and “breaking.” Graffiti artists spread the word of the “I” because the music was all about identity: I am the best. I spread the most love in the Bronx, in Harlem, in Queens. The focus initially was not on the MCs, but on the dancers, or B-boys. Commercial radio ignored it. DJs sold mix tapes out of the back of station wagons. “Rapper’s Delight” by the Sugarhill Gang—the song I first heard at that face-slapping party in Harlem—broke the music onto radio in 1979.

That is the short history.

The long history is that spoken-word music made its way here on slave ships from West Africa centuries ago: Ethnomusicologists trace hip-hop’s roots to the dance, drum, and song of West African griots, or storytellers, its pairing of word and music the manifestation of the painful journey of slaves who survived the middle passage. The ring shouts, field hollers, and spirituals of early slaves drew on common elements of African music, such as call and response and improvisation. “Speech-song has been part of black culture for a long, long time,” says Samuel A. Floyd, director of the Center for Black Music Research at Columbia College in Chicago. The “dozens,”

You can trace hip-hop’s roots to the dance, drum, and song of West African griots. Spoken-word music made its way here on slave ships centuries ago.

“toasts,” and “signifying” of black Americans—verbal dueling, rhyming, self-deprecating tales, and stories of blacks outsmarting whites—were defensive, empowering strategies.

You can point to jazz musicians such as Oscar Brown, Jr., Edgar “Eddie” Jefferson, and Louis Armstrong, and blues greats such as John Lee Hooker, and easily find the foreshadowing of rap music in the verbal play of their work. Black performers such as poet Nikki Giovanni and Gil Scott-Heron, a pianist and vocalist who put spoken political lyrics to music (most famously in “The Revolution Will Not Be Televised”), elevated spoken word to a new level.

But the artist whose work arguably laid the groundwork for rap as we know it was Amiri Baraka, a beat poet out of Allen Ginsberg’s Greenwich Village scene. In the late 1950s and ’60s, Baraka performed with shrieks, howls, cries, stomps, verse floating ahead of or behind the rhythm, sometimes in staccato syncopation. It was performance art, delivered in a dashiki and Afro, in step with the anger of a bold and sometimes frightening nationalistic black movement, and it inspired what might be considered the first rap group, the Last Poets.



ALABAMA Charles “C. J.” Hall, Jr., 17, belts out a call, and the Overcoming Deliverance Church of Today choir lets the response ring to heaven. Whether in spirituals or the most worldly rap, call and response has figured heavily in African-American music for centuries.

I was 13 when I first heard the Last Poets in 1970. They scared me. To black America, they were like the relatives you hoped wouldn't show up at your barbecue because the boss was there—the old Aunt Clementine who would arrive, get drunk, and pull out her dentures. My parents refused to allow us to play their music in our house—so my siblings waited until my parents went to work and played it anyway. They were the first musical group I heard to use the N-word on a record, with songs like “N----- Are Scared of Revolution.” In a world where blacks were evolving from “Negroes” to “blacks,” and the assassinations of civil rights leaders Malcolm X and Martin Luther King, Jr., still reverberated in the air like a shotgun blast, the Last Poets embodied black power. Their records consisted of percussion and spoken-word rhyme. They were wildly popular in my neighborhood. Their debut recording sold 400,000 records in three months, says Last Poet member Umar Bin Hassan. “No videos, no radio play, strictly word of mouth.” The group's demise coincided with hip-hop's birth in the 1970s.

It's unlikely that the Last Poets ever dreamed the revolution they sang of would take the form it has. “We were about the movement,” Abiodun

Oyewole, a founder of the group, says. “A lot of today's rappers have talent. But a lot of them are driving the car in the wrong direction.”

The Crossover

Highways wrap around the city of Dayton, Ohio, like a ribbon bow-tied on a box of chocolates from the local Esther Price candy factory. They have six ladies at the plant who do just that: Tie ribbons around boxes all day. Henry Rosenkranz can tell you about it. “I love candy,” says Henry, a slim white teenager in glasses and a hairnet, as he strolls the factory, bucket in hand. His full-time after-school job is mopping the floors.

Henry is a model American teenager—and the prototypical consumer at which the hip-hop industry is squarely aimed, which has his parents sitting up in their seats. The music that was once the purview of black America has gone white and gone commercial all at once. A sea of white faces now rises up to greet rap groups as they perform, many of them teenagers like Henry, a NASCAR fanatic and self-described redneck. “I live in Old North Dayton,” he says. “It's a white, redneck” (Continued on page 114)

From Africa to the Bronx

A Time Line of Black Music

- Spoken-word Traditions
- African-American Music
- African-influenced Music in Other Countries
- Common Elements of Black Music

preaching

scatting

big band

Fletcher Henderson
Duke Ellington

new orleans jazz

Charles "Buddy" Bolden
Joe "King" Oliver
◀ Louis Armstrong

ragtime

Scott Joplin
Jelly Roll Morton
Eubie Blake

military band music

Black soldiers in military bands blended African rhythms with European brass instruments.

verbal arts

toasting
boasting
signifying
the dozens

vaudeville blues

Ma Rainey
Bessie Smith
Ida Cox
Victoria Spivey
Alberta Hunter

blues

The misery of living in a segregated, Jim Crow society gave rise to the blues, combining the rhythms of field hollers and work songs with instruments such as the guitar and piano.

rural blues

Robert Johnson
Blind Boy Fuller
Brownie McGhee
Blind Lemon Jefferson
Muddy Waters

boogie-woogie

Meade "Lux" Lewis
Charles "Cow Cow" Davenport
Albert Ammons
Roosevelt Sykes
Jimmy Yancey

spirituals

Fisk Jubilee Singers
Hampton Institute

slave-era music

Slaves merged African musical traditions into work songs, field and street cries, folk spirituals, game songs, and instrumental dance music.

griots

In West Africa, storytellers called griots were keepers of cultural history. Their spoken-word traditions gave rise to verbal arts in the U.S.

african roots

1600

1700

1800

1900

1920

1930

tango

Argentina

rumba

Cuba

merengue

samba

Brazil

polyrhythms • bending notes • improvisation • call & response

hip-hop

Born in the South Bronx of the 1970s, hip-hop drew on Afro-Caribbean influences. MCs rapped over loops, samples, and scratches made by DJs using turntables as musical instruments. Hip-hop—America's soundtrack for 30 years—is now a global force.

jazz

The syncopated rhythms and improvisation of ragtime and the blues evolved into jazz, an ensemble-based music that people could dance to. Later styles departed from conventional chord structures, melodies, and rhythms.

swing

- Jimmie Lunceford
- International Sweethearts of Rhythm
- Bennie Moten
- Count Basie
- Billie Holiday
- Cab Calloway

bebop

- Charlie "Bird" Parker
- Dizzy Gillespie
- Thelonious Monk
- Max Roach
- Kenny Clarke
- Ella Fitzgerald
- Sarah Vaughan
- Billy Eckstine

hard bop

- John Coltrane
- Clifford Brown
- Art Blakey
- Horace Silver
- The Jazz Messengers

cool jazz

- The Modern Jazz Quartet
- Miles Davis

spoken-word poetry

- Nikki Giovanni
- Amiri Baraka
- Last Poets
- Gil Scott-Heron
- Sonia Sanchez

free jazz

- Cecil Taylor
- Ornette Coleman
- Archie Shepp
- Sun Ra
- Alice Coltrane

soul jazz

- Jimmy Smith
- Ramsey Lewis
- Cannonball Adderley
- Shirley Scott

fusion

- Herbie Hancock
- George Duke
- Hubert Laws
- George Benson

MCs



rap

east coast

- Run-DMC
- LL Cool J
- Boogie Down Productions
- Salt-n-Pepa
- Beastie Boys
- Public Enemy
- De La Soul
- A Tribe Called Quest
- Queen Latifah
- Wu-Tang Clan
- Notorious B.I.G.
- Missy Elliott
- Jay-Z
- Nas
- Sean Combs
- The Roots
- The Fugees

west coast

- Kool DJ Herc
- Afrika Bambaataa
- Grandmaster Flash & the Furious Five
- Sugarhill Gang
- Kurtis Blow
- Grand Wizard Theodore
- Ice-T
- N.W.A.
- Tupac Shakur
- Dr. Dre
- Snoop Dogg

early hip-hop

neo-traditionalists

- Wynton Marsalis
- Don Byron

new jazz swing

- Branford Marsalis
- Greg Osby
- Steve Coleman
- Geri Allen

gospel

- Kirk Franklin
- Yolanda Adams

r & b

- Prince
- Michael Jackson
- Janet Jackson
- Boyz II Men
- Luther Vandross
- Whitney Houston

rock

- Living Colour
- Lenny Kravitz

electronica

In this hip-hop offshoot, DJs are showcased instead of MCs, and music is produced using computers, drum machines, and synthesizers. In Europe, subgenres exploded from the crucible of American house (Chicago) and techno (Detroit) beats.

house

trance

jungle

downtempo

techno

breakbeat

dancehall

reggaeton

soul

Gospel stylings and socially conscious messages fused with R & B to create soul music. Record labels emerged in Detroit, Memphis, and Philadelphia.

- Aretha Franklin
- James Brown
- Curtis Mayfield
- Stevie Wonder
- Al Green
- The Chi-Lites
- Nina Simone

motown

- Marvin Gaye
- The Four Tops
- The Temptations
- The Supremes
- Jackson 5
- Smokey Robinson & the Miracles

philadelphia international

- The O'Jays
- Billy Paul
- Patti LaBelle
- Teddy Pendergrass

stax

- Otis Redding
- Sam & Dave
- The Staple Singers
- The Bar-Kays
- Isaac Hayes

rhythm & blues

During WWII, rhythm & blues emerged from swing and 12-bar blues as dance music with an emphasis on vocals. *Billboard* magazine coined the phrase in 1949 to replace "race records" as the term for black popular music.

- | | | |
|------------------|---------------|---------------|
| Louis Jordan | The Orioles | The Drifters |
| Johnny Otis | The Moonglows | The Platters |
| King Cole Trio | Fats Domino | The Chantels |
| Charles Brown | Ray Charles | The Shirelles |
| Dinah Washington | Ruth Brown | Sam Cooke |

civil rights freedom songs

rock & roll

In this second generation of R & B, black artists wove in bits of gospel, pop, and country. The music was marketed to white teens as "rock and roll." Black performers were overshadowed by white singers who covered their songs.

- | | |
|----------------|----------------|
| Little Richard | The Cadillacs |
| Chuck Berry | The El Dorados |
| Bo Diddley | The Coasters |
| Etta James | Tina Turner |

rock

- Jimi Hendrix

go-go

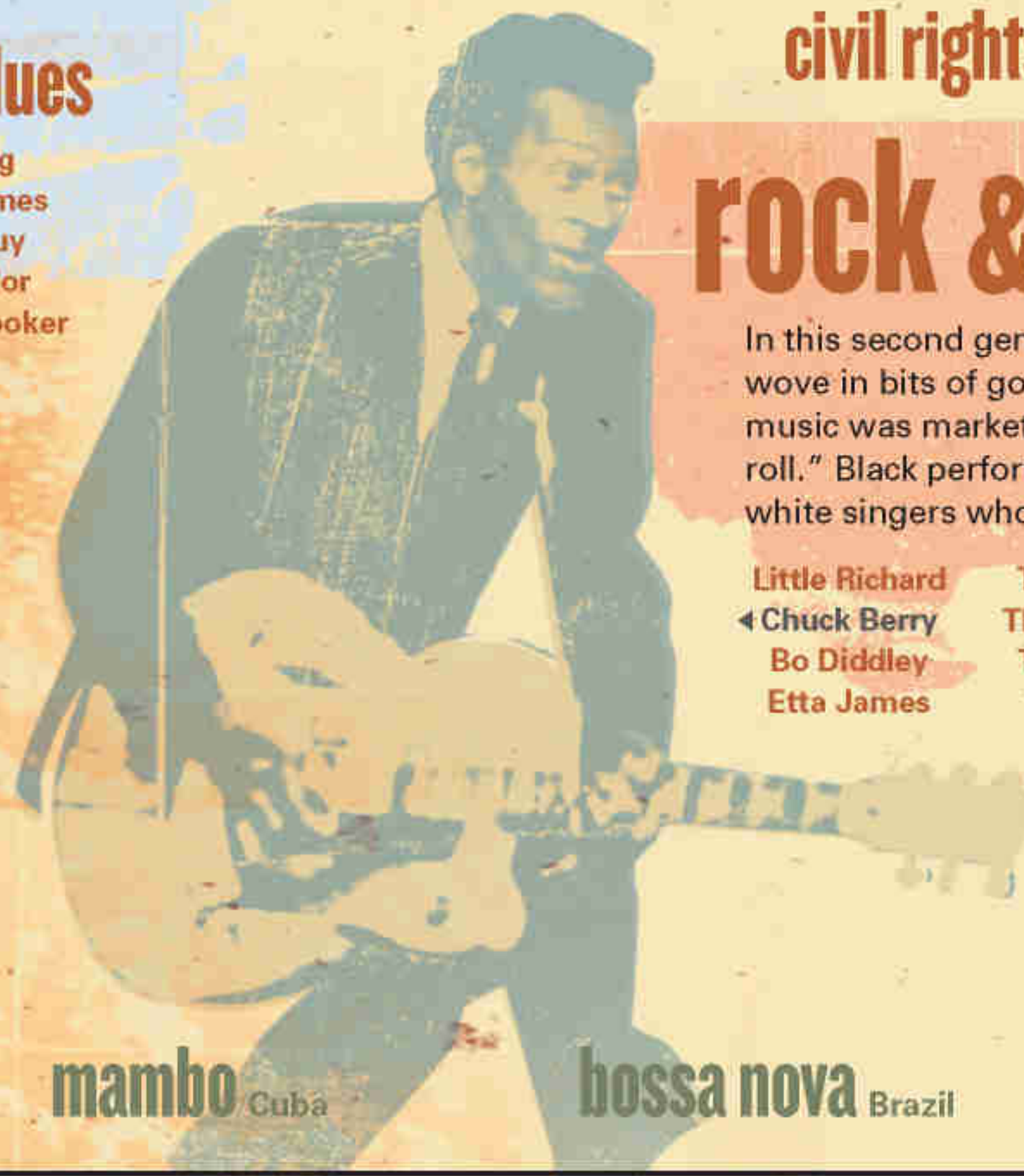
- Chuck Brown
- E.U.
- Trouble Funk
- Rare Essence

disco

- Gloria Gaynor
- Donna Summer
- Village People
- Chic

urban blues

- B. B. King
- Elmore James
- Buddy Guy
- Koko Taylor
- John Lee Hooker



ska

Jamaica

mambo

Cuba

bossa nova

Brazil

rocksteady

Jamaica

reggae

Jamaica

salsa

Puerto Rico/Cuba

Bob Marley

1940

1950

1960

1970

1980

1990

2000

all roads lead to **hip-hop**
in the evolution of **african-american-**
american
music

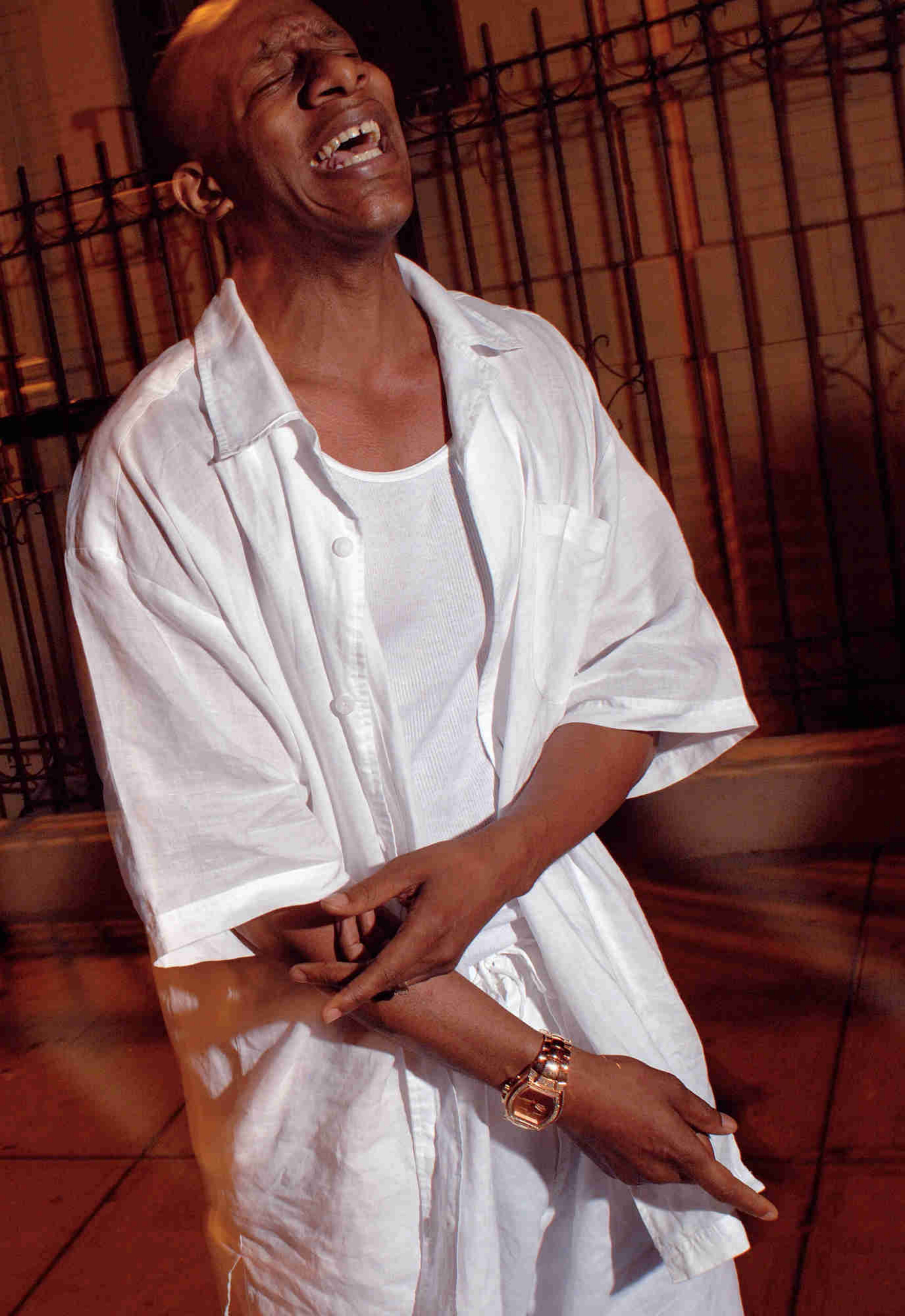
What does an explosive hip-hop track have in common with a ragtime tune or a rousing spiritual? Perhaps not much to a casual listener. Tune in closely, though, and the link becomes clearer. Scholars of music who have put hip-hop through the academic wringer identify the same distinctive elements of African music (syncopation, repetition, audience participation) in the musical genres that Africans developed in the U.S. and other countries where they first arrived as slaves. As the accompanying chart shows, hip-hop is the legitimate heir to a rich tradition of African-American music—the latest in a continuum of music that mirrors the social conditions in which it was created.



Download African-inspired music from around the world, from samba and reggae to international hip-hop at worldmusic.nationalgeographic.com/hiphop.



THE BRONX A streetwise rapper named Mo Slinga busts a freestyle jam on a sweltering night in New York City. In the tradition of African poet-musicians called griots and Jamaican MCs toasting to music, he weaves rhymes on the spot, about the pains and pleasures of everyday life.



(Continued from page 107) area. But hip-hop is so prominent with country people . . . if you put them behind a curtain and hear them talk, you won't know if they're black or white. There's a guy I work with, when Kanye West sings about a gold digger, he can relate because he's paying alimony and child support."

Obviously, it's not just working-class whites, but also affluent, suburban kids who identify with this music with African-American roots. A white 16-year-old hollering rap lyrics at the top of his lungs from the driver's seat of his dad's late-model Lexus may not have the same rationale to howl at the moon as a working-class kid whose parents can't pay for college, yet his own anguish is as real to him as it gets. What attracts white kids to this music is the same thing that prompted outraged congressmen to decry jazz during the 1920s and Tipper Gore to campaign decades later against violent and sexually explicit lyrics: life on the other side of the tracks; its "cool" or illicit factor, which black Americans, like it or not, are always perceived to possess.

Hip-hop has continually changed form, evolving from party music to social commentary with the 1982 release of Grandmaster Flash and the Furious Five's "The Message." Today, alternative hip-hop artists continue to produce socially conscious songs, but most commercial rappers spout violent lyrics that debase women and gays. Beginning with the so-called gangsta rap of the '90s, popularized by the still unsolved murders of rappers Biggie Smalls and Tupac Shakur, the genre has become dominated by rappers who brag about their lives of crime. 50 Cent, the hip-hop star of the moment, trumpets his sexual exploits and boasts that he has been shot nine times.

"People call hip-hop the MTV music now," scoffs Chuck D, of Public Enemy, known for its overtly political rap. "It's Big Brother controlling you. To slip something in there that's indigenous to the roots, that pays homage to the music that came before us, it's the Mount Everest of battles."

Most rap songs unabashedly function as walking advertisements for luxury cars, designer clothes, and liquor. Agenda Inc., a "pop culture brand strategy agency" listed Mercedes-Benz as the number one brand mentioned in *Billboard's* top 20 singles in 2005. Hip-hop sells so much Hennessy cognac, listed at number six, that the French makers, deader than yesterday's beer a decade ago, are now rolling in suds. The

What attracts white kids to this music is life on the other side of the tracks, its "cool" or illicit factor, which black Americans, like it or not, are always perceived to possess.

company even sponsored a contest to win a visit to its plant in France with a famous rapper.

In many ways, the music represents an old dream. It's the pot of gold to millions of kids like Henry, who quietly agonizes over how his father slaves 14 hours a day at two tool-and-die machine jobs to make ends meet. Like teenagers across the world, he fantasizes about working in the hip-hop business and making millions himself.

"My parents hate hip-hop," Henry says, motoring his 1994 Dodge Shadow through traffic on the way home from work on a hot October afternoon. "But I can listen to Snoop Dogg and hear him call women whores, and I know he has a wife and children at home. It's just a fantasy. Everyone has the urge deep down to be a bad guy or a bad girl. Everyone likes to talk the talk, but not everyone will walk the walk."

Full Circle

You breathe in and breathe out a few times and you are there. Eight hours and a wake-up shake on the flight from New York, and you are on the tarmac in Dakar, Senegal. Welcome to Africa. The assignment: Find the roots of hip-hop. The



OHIO Paco Arias (in Cardinals jersey) escaped a world of gangs and violence when he moved from a rough Chicago neighborhood to suburban Dayton. The 14-year-old soon linked up with other teens who share his love of hip-hop, far from the conditions in which it arose.

music goes full circle. The music comes home to Africa. That whole bit. Instead it was the old reporter's joke: You go out to cover a story and the story covers you. The stench of poverty in my nostrils was so strong it pulled me to earth like a hundred-pound ring in my nose. Dakar's Sandaga market is full of "local color"—unless you live there. It was packed and filthy, stalls full of new merchandise surrounded by shattered pieces of life everywhere, broken pipes, bicycle handlebars, fruit flies, soda bottles, beggars, dogs, cell phones. A teenage beggar, his body malformed by polio, crawled by on hands and feet, like a spider. He said, "Hey brother, help me." When I looked into his eyes, they were a bottomless ocean.

The Hotel Teranga is a fortress, packed behind a concrete wall where beggars gather at the front gate. The French tourists march past them, the women in high heels and stonewashed jeans. They sidle through downtown Dakar like royalty, haggling in the market, swimming in the hotel pool with their children, a scene that resembles Birmingham, Alabama, in the 1950s—the blacks serving, the whites partying. Five hundred yards away, Africans eat off the sidewalk and sell peanuts for a pittance. There is a restlessness, a

deep sense of something gone wrong in the air.

The French can't smell it, even though they've had a mouthful back home. A good amount of the torching of Paris suburbs in October 2005 was courtesy of the children of immigrants from former French African colonies, exhausted from being bottled up in housing projects for generations with no job prospects. They telegraphed the punch in their music—France is the second largest hip-hop market in the world—but the message was ignored. Around the globe, rap music has become a universal expression of outrage, its macho pose borrowed from commercial hip-hop in the U.S.

In Dakar, where every kid is a microphone and turntable away from squalor, and American rapper Tupac Shakur's picture hangs in market stalls of folks who don't understand English, rap is king. There are hundreds of rap groups in Senegal today. French television crews troop in and out of Dakar's nightclubs filming the kora harp lute and *tama* talking drum with regularity. But beneath the drumming and the dance lessons and the jingling sound of tourist change, there is a quiet rage, a desperate fury among the Senegalese, some of whom seem to bear an





SPAIN All eyes in the club are on Fátima Milán Cabezas as she moves to a hip-hop beat in Barcelona. A New World creation with African roots, hip-hop has become a vehicle for youth expression and rebellion in cultures from Europe to Asia.

intense dislike of their former colonial rulers.

"We know all about French history," says Abdou Ba, a Senegalese producer and musician. "We know about their kings, their castles, their art, their music. We know everything about them. But they don't know much about us."

Assane N'Diaye, 19, loves hip-hop music. Before he left his Senegalese village to work as a DJ in Dakar, he was a fisherman, just like his father, like his father's father before him. Tall, lean, with a muscular build and a handsome chocolate face, Assane became a popular DJ, but the equipment he used was borrowed, and when his friend took it back, success eluded him. He has returned home to Toubab Dialaw, about 25 miles south of Dakar, a village marked by a huge boulder, perhaps 40 feet high, facing the Atlantic Ocean.

About a century and a half ago, a local ruler led a group of people fleeing slave traders to this place. He was told by a white trader to come here, to Toubab Dialaw. When he arrived, the slavers followed. A battle ensued. The ruler fought bravely but was killed. The villagers buried him by the sea and marked his grave with a small stone, and over the years it is said to have sprouted like a tree planted by God. It became a huge, arching boulder that stares out to sea, protecting the village behind it. When the fishermen went deep out to sea, the boulder was like a lighthouse that marked the way home. The Great Rock of Toubab Dialaw is said to hold a magic spirit, a spirit that Assane N'Diaye believes in.

In the shadow of the Great Rock, Assane has built a small restaurant, *Chez Las*, decorated with hundreds of seashells. It is where he lives his hip-hop dream. At night, he and his brother and cousin stand by the Great Rock and face the sea. They meditate. They pray. Then they write rap lyrics that are worlds away from the bling-bling culture of today's commercial hip-hoppers. They write about their lives as village fishermen, the scarcity of catch forcing them to fish in deeper and deeper waters, the hardship of fishing for 8, 10, 14 days at a time in an open pirogue in rainy season, the high fee they pay to rent the boat, and the paltry price their catches fetch on the market. They write about the humiliation of poverty, watching their town sprout up around them with rich Dakarians and richer French. And they write about the relatives who leave in the morning and never return, surrendered to the sea, sharks, and God.

"Rap doesn't belong to American culture," Assane N'Diaye says. "It belongs here. It has always existed here, because of our pain and our hardships and our suffering."

The dream, of course, is to make a record. They have their own demo, their own logo, and their own name, Salam T. D. (for Toubab Dialaw). But rap music represents a deeper dream: a better life. "We want money to help our parents," Assane says over dinner. "We watch our mothers boil water to cook and have nothing to put in the pot."

He fingers his food lightly. "Rap doesn't belong to American culture," he says. "It belongs here. It has always existed here, because of our pain and our hardships and our suffering."

On this cool evening in a restaurant above their village, these young men, clad in baseball caps and T-shirts, appear no different from their African-American counterparts, with one exception. After a dinner of chicken and rice, Assane says something in Wolof to the others. Silently and without ceremony, they take every bit of the leftover dinner—the half-eaten bread, rice, pieces of chicken, the chicken bones—and dump them into a plastic bag to give to the children in the village. They silently rise from the table and proceed outside. The last I see of them, their regal figures are outlined in the dim light of the doorway, heading out to the darkened village, holding on to that bag as though it held money.



SENEGAL Hip-hop comes full circle on a beach outside Dakar. Jally, a kora-playing griot who makes a living telling stories at ritual ceremonies (or for tourists), jams with Omar N’Gala Seck, a rapper who infuses the American form with fresh shots of its African roots.

The City of Gods

Some call the Bronx River Houses the City of Gods, though if God has been by lately, he must’ve slipped out for a chicken sandwich. The 10 drab, red-brick buildings spread out across 14 acres, coming into view as you drive east across the East 174th Street Bridge. The Bronx is the hallowed holy ground of hip-hop, the place where it all began. Visitors take tours through this neighborhood now, care of a handful of fortyish “old-timers,” who point out the high and low spots of hip-hop’s birthplace.

It is a telling metaphor for the state of America’s racial landscape that you need a permit to hold a party in the same parks and playgrounds that produced the music that changed the world. The rap artists come and go, but the conditions that produced them linger. Forty percent of New York City’s black males are jobless. One in three black males born in 2001 will end up in prison. The life expectancy of black men in the U.S. ranks below that of men in Sri Lanka and Colombia. It took a massive hurricane in New Orleans for the United States to wake up to its racial realities.

That is why, after 26 years, I have come to

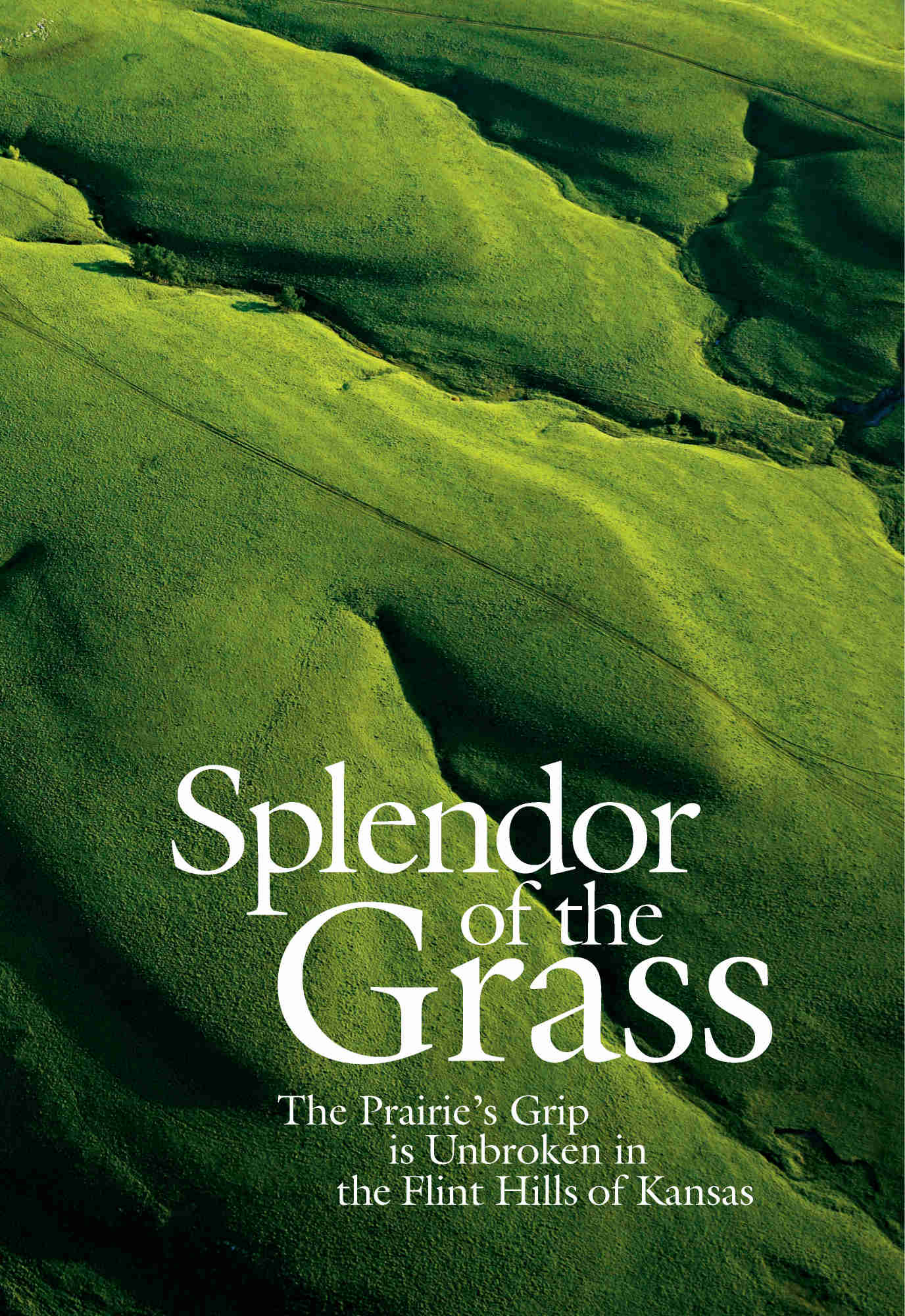
embrace this music I tried so hard to ignore. Hip-hop culture is not mine. Yet I own it. Much of it I hate. Yet I love it, the good of it. To confess a love for a music that, at least in part, embraces violence is no easy matter, but then again our national anthem talks about bombs bursting in air, and I love that song, too. At its best, hip-hop lays bare the empty moral cupboard that is our generation’s legacy. This music that once made visible the inner culture of America’s greatest social problem, its legacy of slavery, has taken the dream deferred to a global scale. Today, 2 percent of the Earth’s adult population owns more than 50 percent of its household wealth, and indigenous cultures are swallowed with the rapidity of a teenager gobbling a bag of potato chips. The music is calling. Over the years, the instruments change, but the message is the same. The drums are pounding out a warning. They are telling us something. Our children can hear it.

The question is: Can we? □

✦ **Hip-Hop Journey** Photographer David Alan Harvey takes you inside the world of hip-hop, from street rappers in the South Bronx to the griots of West Africa, at ngm.com/0704.



Fresh growth carpets one of the last strongholds of tallgrass prairie on the continent. Much that remains of this once vast ecosystem lies here in the Flint Hills, saved from the plow by stubborn layers of stone jutting rawboned through thin soil.



Splendor of the Grass

The Prairie's Grip
is Unbroken in
the Flint Hills of Kansas





Grasses depend on fire to sweep the prairie clean. Spring burns kill trees and scorch off last year's dry overburden, baring the ground to sun and rain. Within days, the black earth shows green again, as new shoots grow from roots unscathed by the flames. Within weeks, showy evening primroses (above) spread their petals, joining a wildflower pageant 650 species strong.

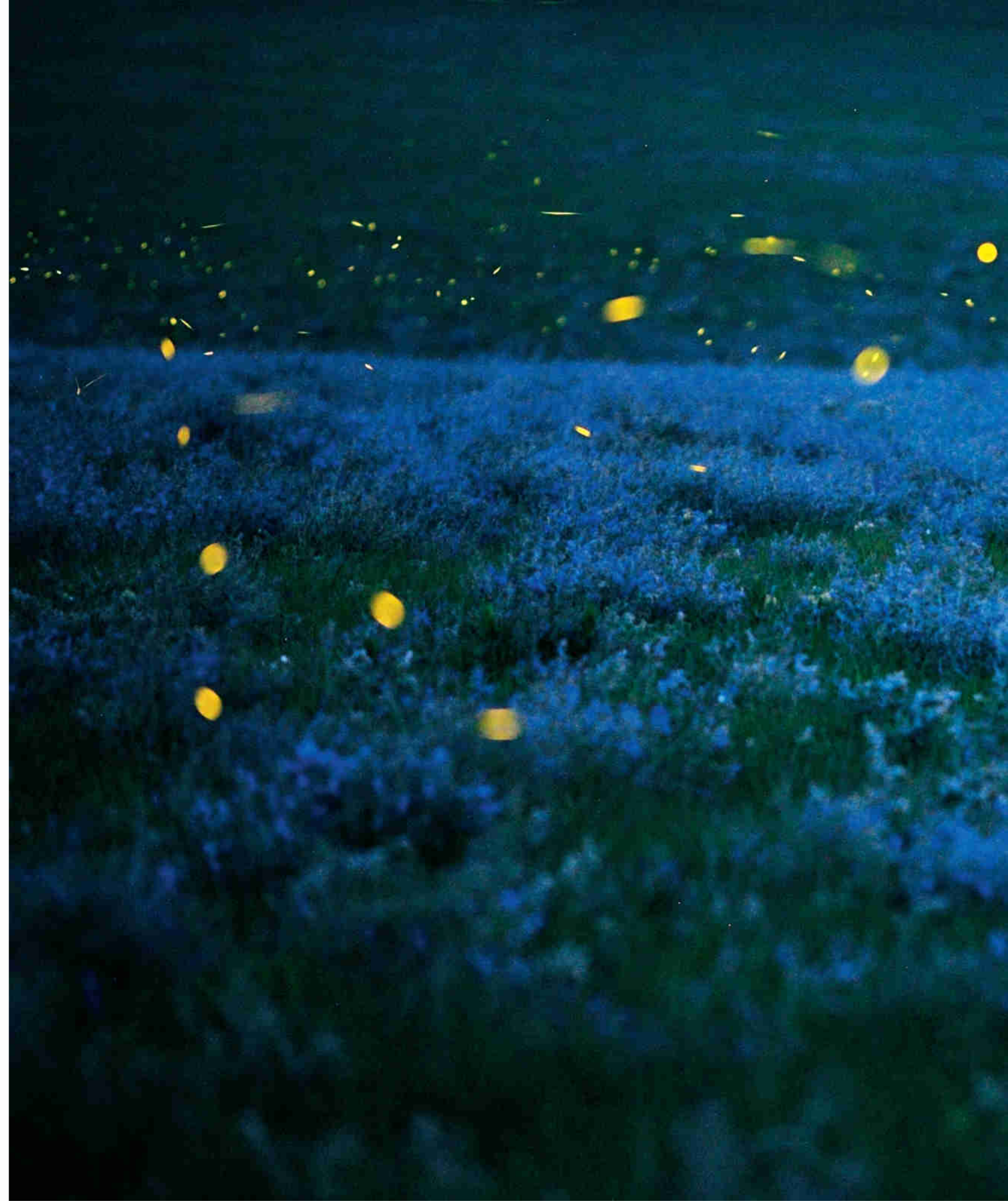




Burnished gold just moments before sunset, the braided hills of the Konza Prairie Preserve roll to the horizon. The grass is the country, wrote Great Plains novelist Willa Cather, "as the water is the sea."



The intricacy of prairie life doesn't shout. Slow down: You'll miss it if you're just passing through. Get down on your knees to see the frills of long-bracted spiderwort (above). The inch-wide blossoms last just a day. Stop in the gathering twilight and watch fireflies dance against a fragrant backdrop of wild alfalfa. Their riot of luminescent insect lust may go on full force for more than an hour.





Americans have always lived in a land of possibility—a place where the grass is “hopeful green stuff,” as the poet Walt Whitman put it. Our habit is to wonder what we can make of a place, to gaze at the future instead of the present. As a result, nature often lies hidden beneath our expectations. That’s why the Flint Hills of Kansas—the last great swath of tallgrass prairie in the nation—can be so hard to grasp. The Flint Hills are no longer hard to get to, no longer a matter of ox train and overland trail from somewhere east of the Missouri River. They’re transected by roads of every description now. But when you get to the hills,

when you rise onto the low shield of flint and limestone that defines them and walk up onto the highest brow and stand into the wind that’s trying to pry your ears apart, what do you see?

Open sky, open land, unending horizon, the “limitless and lonesome prairie,” to quote Whitman again. But the word that also springs to mind may be “nothing.” A glorious nothing, but nothing nonetheless.

That too is an American word, full of the conviction that nothing much stands between herds of bison and herds of cattle, between the millions of acres of tallgrass prairie that once

stretched across the plains and the millions of acres of corn and soybeans growing there now. Historically, we have valued the prairie grasses mainly as cattle fodder or as placeholders till the sod could be broken and crops planted, crops that are themselves just placeholders until the houses eventually come. The prairie topography is almost too subtle for us, which may be one reason the National Park System contains only a single unit dedicated to grassland—the Tallgrass Prairie National Preserve in Chase County, Kansas, the heart of the Flint Hills.

When you walk across the grassbound hills

Faint heart—or voice—never won fair maiden. In the spring dawn prairie-chickens gather on “booming grounds,” where males declare their prowess with resonant cries, then face off in dramatic aerial jousts (right). Females may visit several different arenas and choose their mates from among the champions.



above Fox Creek, just northwest of the small town of Strong City, it's easy to pretend you're striding through the past. There is no sound or sight to remind you of the immediate century. But that reverie too is a way of failing to notice the grassland. The hard part here in the Flint Hills—and in any of the few remaining patches of native prairie—is learning to see the tallgrass ecosystem for itself. It is a study in the power of modesty. Learn it well enough and you begin to suspect that grasses are what hold this world together.

Some of the lowlands in the Flint Hills are

planted to corn and milo, and the creek bottoms are full of oaks and an occasional white-limbed sycamore. Along the gravel roads you come across old limestone fences and Osage orange trees, or bois d'arc, planted by the settlers as hedge and windbreak. But on the uplands—and the Flint Hills are mostly upland, stretching from northern Kansas down into Oklahoma—the prairie still holds its own. The soils are too thin, too rock-strewn to make good farmland. Wherever you walk, you find drifts of limestone, like fallen grave markers, grass pushing through the holes that time has made

in that soluble stone. The very toughness of this place—amply recorded by its early occupants—has helped preserve it.

That toughness is more than mirrored in the grasses themselves, especially in species like big bluestem—one of the dominant grasses in the Flint Hills. Big bluestem (*Andropogon gerardii*) persists from year to year, spreading by seed and rhizome, creating an underground web of coarse roots near the surface as well as fine root fibers that may reach eight feet deep where the soil allows. What grows above ground—the tillers—is essentially disposable. The actual growing tip of the plant lies low to the earth in spring and is undisturbed when the tillers are cropped or singed. Like most of the other plants in the tallgrass ecosystem,

hunted down as relentlessly as if it were a sheep-killing wolf. But in the Flint Hills fire still thrives because the ranchers here depend on a natural ecosystem. Even in the mid-19th century, cattlemen understood that the richness of the Flint Hills grasses depended on a good spring burn—something they learned from the Native Americans they displaced. And so, early each April—even as the cattle that will graze down the prairie are shipping in—the hills go up in smoke.

The balance isn't perfect, of course. Without human intervention, the Flint Hills would burn more randomly than they do now, creating a broader range of habitats than frequent burns allow. Annual burning may suppress some species—including prairie-chickens, whose

See the tallgrass prairie for itself, and you begin to

big bluestem actually rejoices in grazing and fire, if they come at the right time of year.

The prairie is sometimes called a sea of grass—a metaphor that points to the endless green expanse and the wavelike motion of the grasses. But there is also a tide in these grasslands—a cycle of growth that sweeps chronologically across the Flint Hills. High tide comes early in the year. The prairie swells into life in early spring, and if fire comes then, the plants respond with a redoubled burst of growth. The fires clear away last year's plant debris, letting in more light and warming the soil.

To the grazers on the hills—bison once and cattle now—the new green on blackened ground is a timely feast. In the cycle of warm-season grasses like big bluestem, this is the peak of their nutritional richness. They continue to grow all through the summer, but as the weeks pass they harden off until, in autumn, their leaves are somber, dried remnants of themselves, crimson, maroon, clattering in the wind.

In most of America, agriculture has meant replacing the incredible complexity of a natural ecosystem with the incredible simplicity of a single crop growing on bare ground. And almost everywhere, fire was the first thing banished,

numbers have plummeted—that might flourish in a more complicated tangle of grasses. There is also a worrying trend toward ground and aerial spraying with broad-spectrum herbicides to control a highly invasive weed called sericea lespedeza, introduced decades ago to curb erosion around mines and provide forage and cover for wildlife around reservoirs.

And yet the Flint Hills is one of the few places in the United States where the prevailing agricultural system works essentially in tandem with an ancestral native ecosystem, preserving most of its complexity and the dynamic processes that helped shape it. First comes the fire, then for a few months the cattle—intensively stocked—and then the hills are left to themselves.

The springtime sacrifice of grasses does more than fatten steers. It is the prairie's only defense against woods and heavy brush. Wherever the range fires have lapsed, trees begin to move in, especially eastern red cedar. Deep in the tallgrass, it is hard to imagine that this lush growth cannot hold its own against woody species. The prairie seems so durable, so all-encompassing. And yet the prairie is the natural habitat of fire. So far, the way the land has been settled—sparsely and mostly in the bottomland—still

leaves room for the flames of spring to sweep unchecked across the upland horizon.

In the Flint Hills, you instinctively feel that the prairie is for looking outward. But to see it truly, you have to look downward, past the seedheads of switchgrass and Indian grass, past the flowers of leadplant and stiff goldenrod, and down into the roots. This is not just an act of imagination. Here and there, you come across the cutbank of a shallow stream, and you can glimpse in the exposed earth an unraveling skein of tough fibers working their way downward. It's enough to make you doubt the priority of what grows upward. The grass leaves and stems and inflorescences seem to exist to serve the roots, rather than the other way around.

The Flint Hills lie at the western edge of the



suspect that grasses are what hold this world together.

tallgrass prairie ecosystem, and except in wet, sheltered spots, the tallgrass species here grow much shorter than they do farther east. In late summer, walking through a patch of restored Illinois prairie, you can almost imagine the scale of the root system, because it is mirrored in the head-high plants all around you. But here the prairie is surprisingly asymmetrical. The late-summer grasses and forbs, burned and grazed earlier in the year, rarely stand more than knee-high. They give no hint of what lies beneath them.

Even the cutbank does not reveal the mass and density of the roots pushing beneath the prairie surface. But imagine the prairie upside down—the leaves and stems growing downward into the soil and the roots of all these species growing skyward. You are suddenly walking through a dense, tenacious thicket of roots. The horizon is gone because you are over-ears in plant fibers, some spreading and slender, some tall, with strange bulbous growths on them. It is as though you were walking through a forest of veins and capillaries, each species finding a different niche—a different height, a different strategy—in the competition for resources.

This image alone cannot convey how tightly

the prairie roots—rightside down—grasp the soil into which they have plunged, how closely they bind the earth and sky. Part of the pleasure of walking through the Flint Hills is sensing that coherence underfoot, the way the prairie roots have woven the soil together and anchored a stunningly diverse community above and below the soil line.

Just how the prairie speaks to you depends on who you are. Some will find it full of nothing or full, at best, of cattle fodder and copious views. But like any ecosystem that remains more than a shadow of itself, the tallgrass prairie also reminds us how we should think about the life that surrounds us. Spring brings the fires, the solid hopeful green of new grass, the booming of mating prairie-chickens in the Flint Hills. Our old habits of seeing find in all of this a familiar simplicity, the kind you push past on your way to a more human future. But in the ancient prairie itself—in its diversity, its coherence, its community, its capacity for regeneration—there is a new way of seeing waiting to be found.

📌 **Last of the Prairie Sea** Learn the surprising history of the Tallgrass Prairie National Preserve and more about conservation at ngm.com/0704.

Photographer Jim Richardson raced a chain of thunderstorms from his home in Lindsborg, Kansas, through the Flint Hills. "I stopped and this storm was on me, hammering rain," he recalls. Two minutes later the fury had passed—and a rainbow arced across the sky.







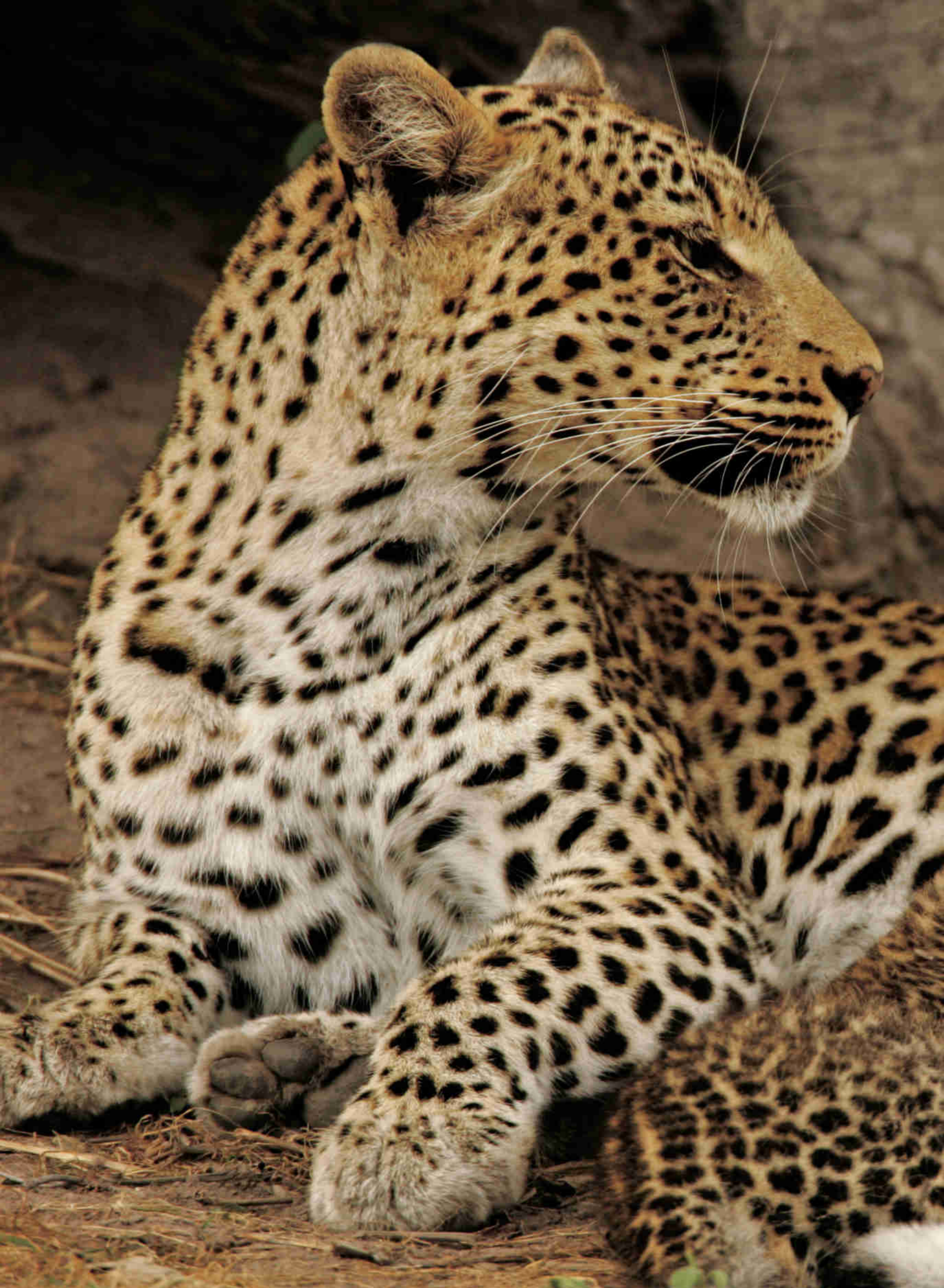


By late summer, the plants have seized all the sustenance they can from air and earth. Winds scatter seed from grasses turned scarlet, rust, even lavender. The goldenrod finally lives up to its name. And before autumn fully arrives, frost begins to tear apart summer's workmanship, breaking down leaf and stalk so their nutrients return to the soil, ready to nourish next year's prairie rebirth.





Where the tallgrass survives,
so does night dark enough to
reveal the glittering banner of
the Milky Way flung against the
sky. Stars wheel above us seen
or not, but if we don't see—and
treasure—the last of the prairie,
it may vanish from underfoot. □



LESSONS OF THE HUNT

A mother leopard can teach her cub many things about surviving in Botswana's Okavango Delta. But some skills a cub must pick up on her own—often through life-threatening experiences.



BY DERECK JOUBERT

PHOTOGRAPHS BY BEVERLY JOUBERT

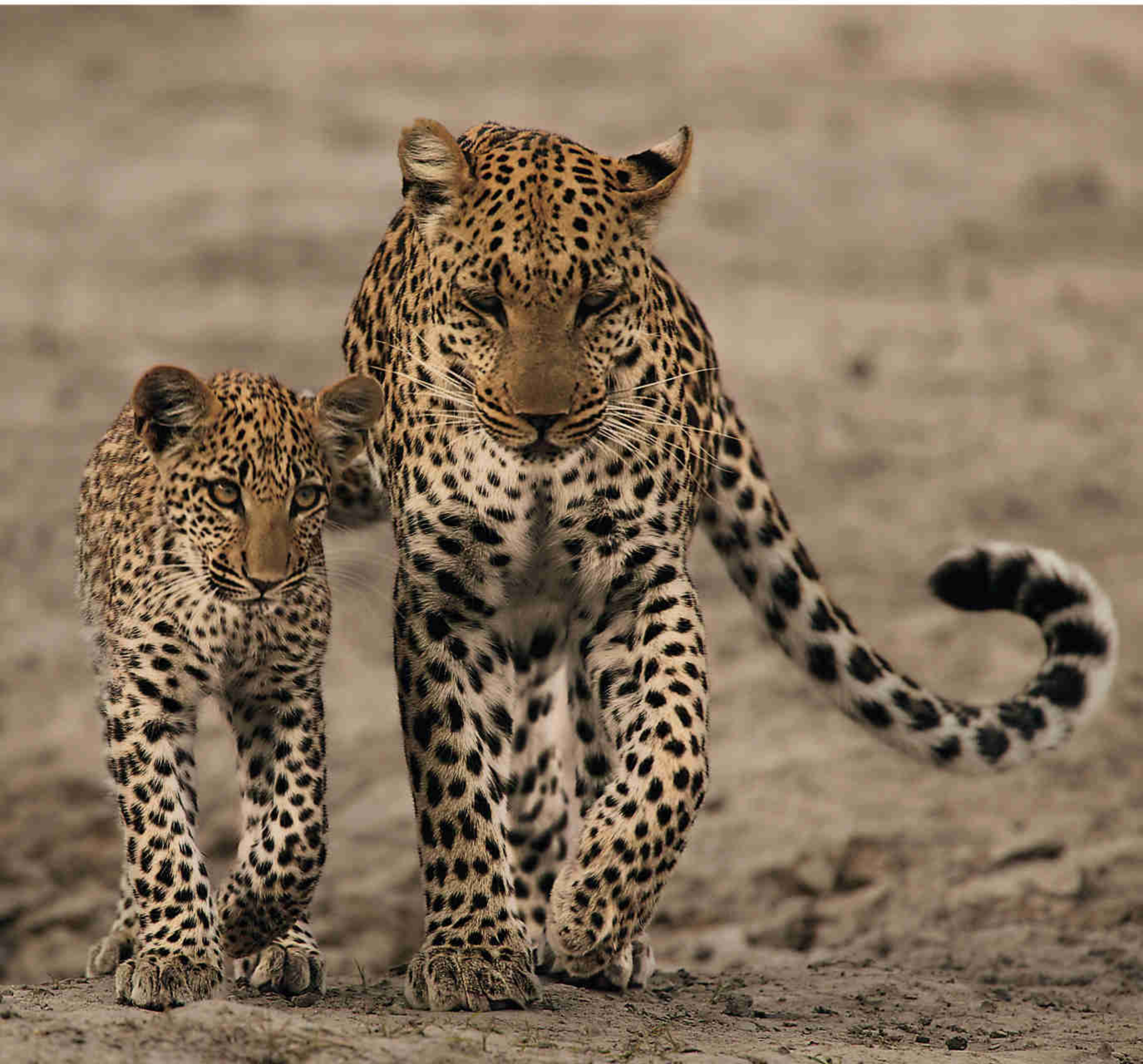
She was eight days old when we spotted her. Her eyes were still milky gray, and she wobbled slightly. Emerging into the sunlight from her den, she seemed curious and bold, taking no notice of screeching squirrels. Her mother had lost five previous cubs to hyenas, baboons, and other predators. What would happen to this one?

Unlike lions or cheetahs, leopards are secretive, solitary cats. Without a family to depend on, they hunt alone, slinking through the shadows, surviving on stealth and intelligence. Finding any leopard is difficult, so when we discovered this mother and cub in the thick groves of ebony and acacia trees at Mombo, an area in Botswana's Okavango Delta, we decided to follow the little one as she grew up.

From her first days, Legadema, as we came to call her ("light from the sky" in the Setswana language), was under constant threat. Whether it was a troop of baboons that tried to drag both mother and daughter out of their den, or the lurking hyenas, death was never far away. Lions, a significant threat to young leopards, thrive in this part of the Moremi Game Reserve. But none of this kept Legadema from exploring the forest on her own when her mother left her alone for days at a time to bring back meat. Wherever Legadema went, vervet monkeys with darting eyes spotted her a mile off, and squirrels set up alarm calls. In time, these incidents only made her better at concealment and stealth.

Her mother, a patient teacher, instructed Legadema in the skills she would need to survive as a predator: how to pin down prey and where to clamp on their throats with her jaws to suffocate them. Only after mastering these and many other lessons would she grow into the solitary hunter that all leopards must one day become.





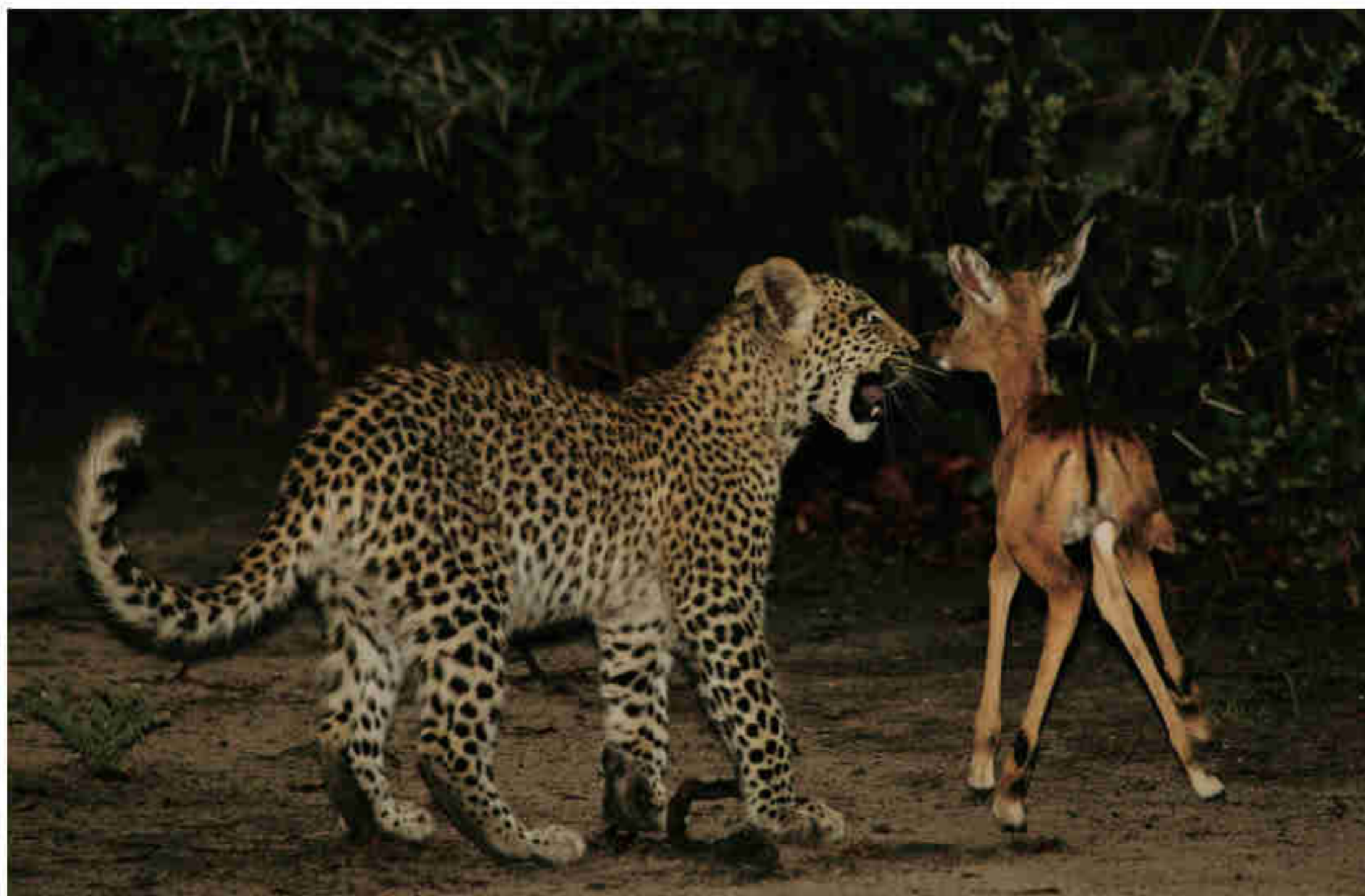
As they patrolled their territory in Mombo and hunted together, Legadema seemed a mirror image of her mother. The two formed a strong bond during the first year, sometimes playing like siblings.



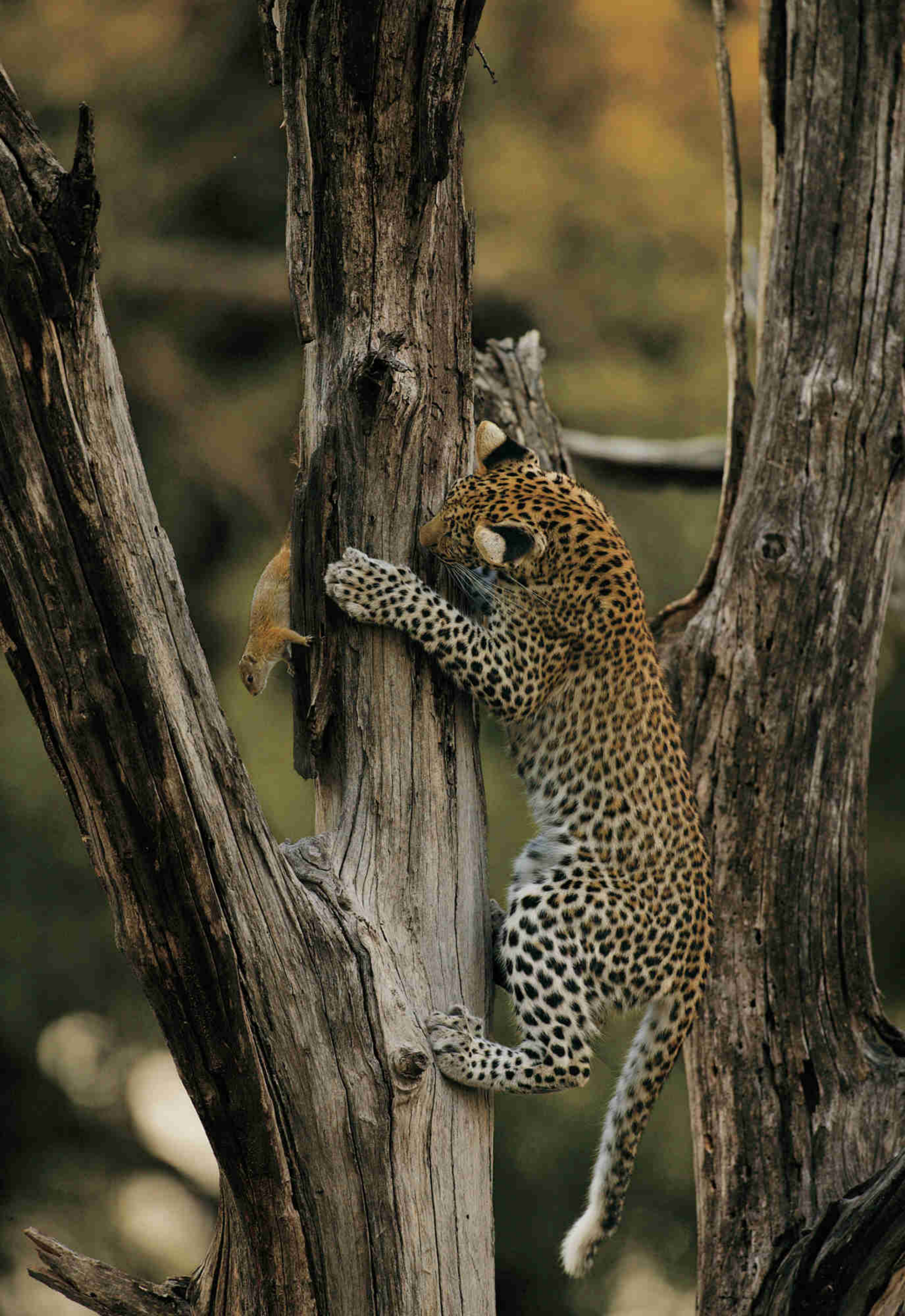


Scrambling to save her from a 60-foot fall during horseplay, Legadema's mother wrestled the cub back onto a branch—a tricky maneuver for an animal equipped only with teeth, claws, and determination.

MOTHER GIVES A
LESSON IN THE
ART OF THE KILL.



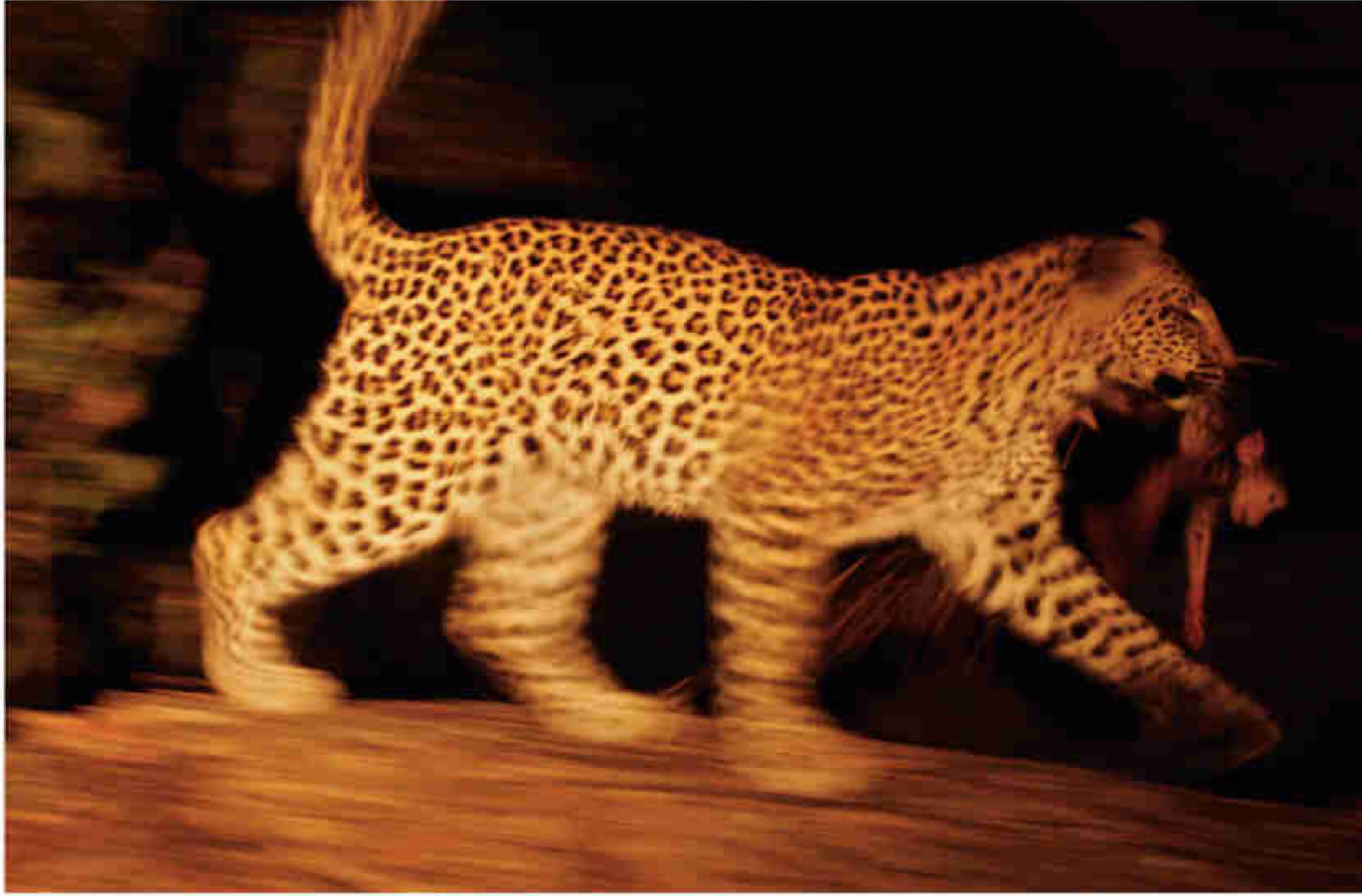
When Legadema was five months old, her mother brought her a live baby impala (top). At first Legadema wasn't sure what to do, playing inquisitively, then attacking ineffectually (above). Her mother guided her tolerantly through every step of the kill, until at last Legadema learned that living animals can become a meal. Her predator skills honed, Legadema turned her attention to squirrels, becoming almost obsessed with dizzying and deadly games of hide-and-seek (right). Over time, she grew adept, killing hundreds of squirrels as well as such larger prey as baby warthogs.



AFTER KILLING
THE ADULT BABOON,
SHE NOTICES THE BABY.



Despite her deep fear of baboons, Legadema one day killed an adult female. When she discovered a newborn clinging to the baboon mother's fur, the situation took a bizarre turn. The tiny baboon innocently reached out to Legadema, accepting her as its new mother. Legadema initially seemed confused, but for the next four hours, she watched over the baby baboon (above), then groomed it and gently carried it to safer branches higher in the tree whenever the baby cried (top right). Eventually the two cuddled together and went to sleep (bottom right). Was Legadema feeling early maternal instincts? Before the night was over, the cold claimed the life of the helpless infant, and Legadema left the baby to resume her role as predator, feeding on the mother baboon's body.

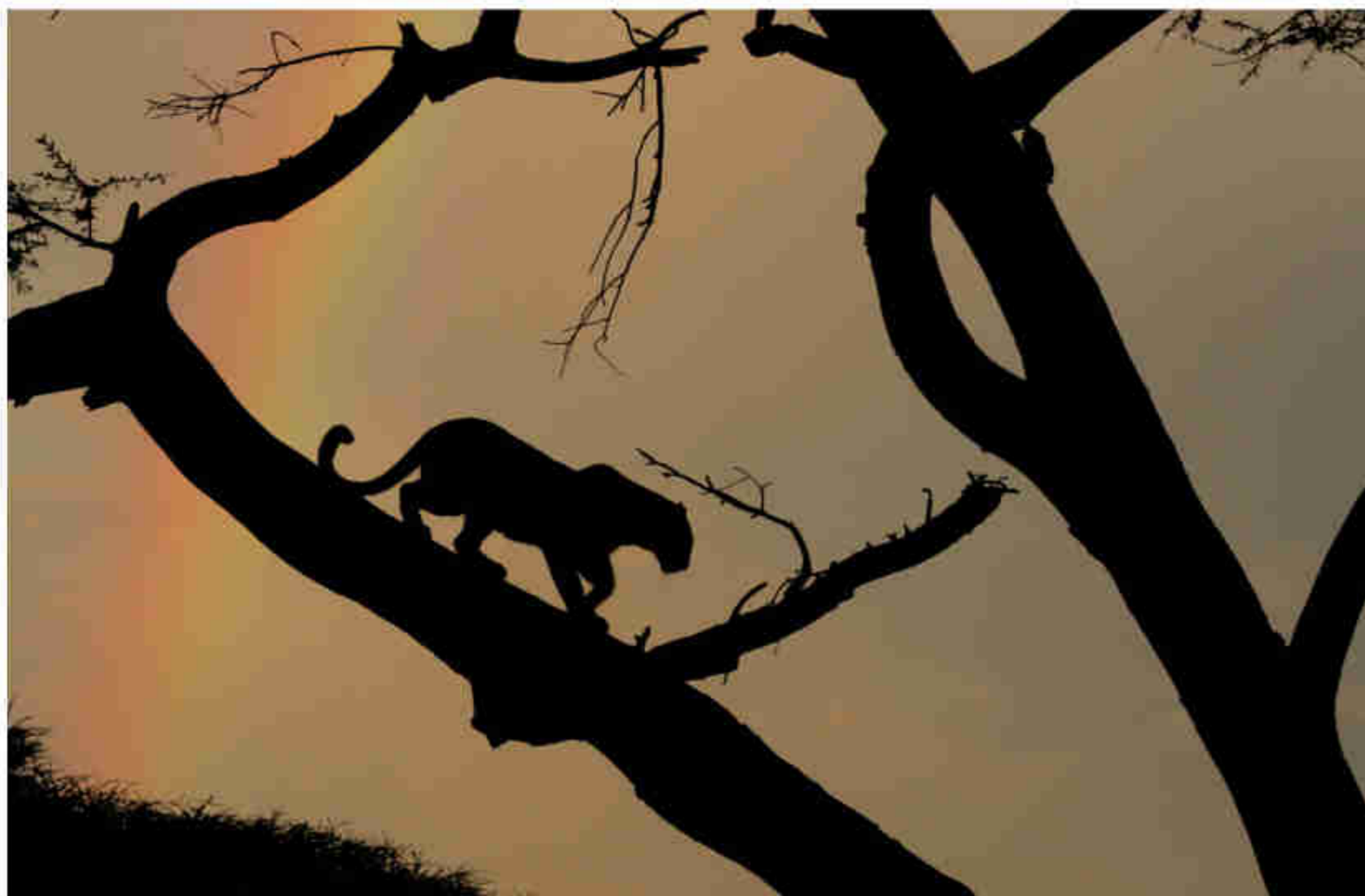




Growing more independent, Legadema was preparing for the day when she would stake her own claim in the forest. But the six-month-old, right, still seemed reassured by the touch of her mother's tail.



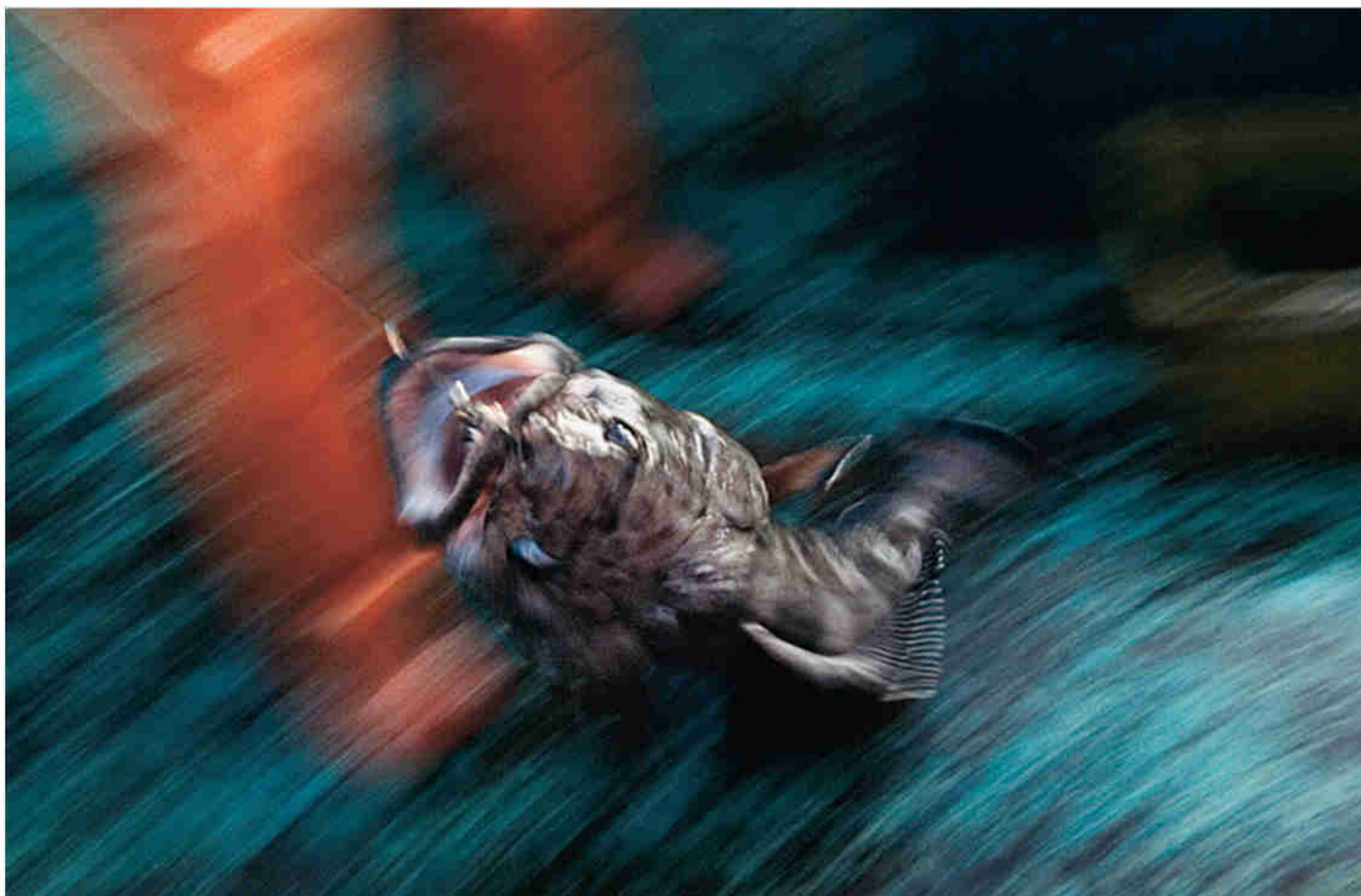
NOW FULLY GROWN,
SHE LEAVES HER MOTHER
AND CLAIMS HER SPACE.



At 13 months old—still an adolescent—Legadema got into a spat with her mother that escalated into a permanent rift. The cause: Legadema's refusal to share a kill. Although tension between the two had been building for some time, Legadema was now demonstrating her independence, and her mother drove her away. Dissolving into the thickets (right), Legadema shared a part of her mother's territory for a while. Later she established her own territory, moving like a ghost through the forest (above). Late last year, at age three and a half, she mated. If she and her young stay within Moremi, they will be safe from harm by humans. But elsewhere in Africa leopards are not as fortunate. Some 2,500 a year are permitted to be shot by hunters, and at least as many are killed by poachers. As conflicts with people and livestock continue, fewer and fewer leopards are likely to enjoy a life as free as young Legadema's. □

↗ **Leopards in Action** Watch scenes from the Jouberts' film *Eye of the Leopard* and get a glimpse into the making of the show at ngm.com/0704.





Delicious, but in rapid decline, a Patagonian toothfish (aka Chilean sea bass) flops aboard a Chilean fishing ship.

GLOBAL FISH CRISIS, PAGE 32 **Fish Dish** Seafood lovers have a lot of concerns: Wild-caught or farm-raised fish? Sustainably harvested or whatever is fresh? High mercury levels? The good news is that for most adults—save for those pregnant or nursing—a recent Harvard School of Public Health study found that benefits of eating fish, particularly those rich with omega-3 fatty acids, outweigh risks from contaminants such as mercury often found in them. The bad news: We're eating fish nearly out of existence, and major stocks could collapse by mid-century if nations don't curtail the harvest. Advocacy groups offer seafood guides to help buyers make informed decisions about fish consumption. Though lists change from year to year and vary by region, a few species high in omega-3s and low in contaminants come from well-managed fisheries and tend to make the grade across the board.

Choose Safe, Sustainable Fish

- Wild Alaska salmon
- Canned pink or sockeye salmon
- Anchovies
- Sardines
- Alaska sablefish (black cod)
- Atlantic herring
- Atlantic mackerel
- Farmed oysters

Avoid High-mercury Fish

- Tilefish (golden bass)
- King mackerel
- Shark
- Swordfish
- Freshwater sport fish caught in contaminated waters

For More Information

These organizations offer up-to-date lists of the wisest fish choices:

Monterey Bay Aquarium provides detailed regional and national guides to seafood. mbayaq.org/cr/seafoodwatch.asp

Environmental Defense highlights fish species high in omega-3s—and also those high in contaminants. oceansalive.org/eat.cfm

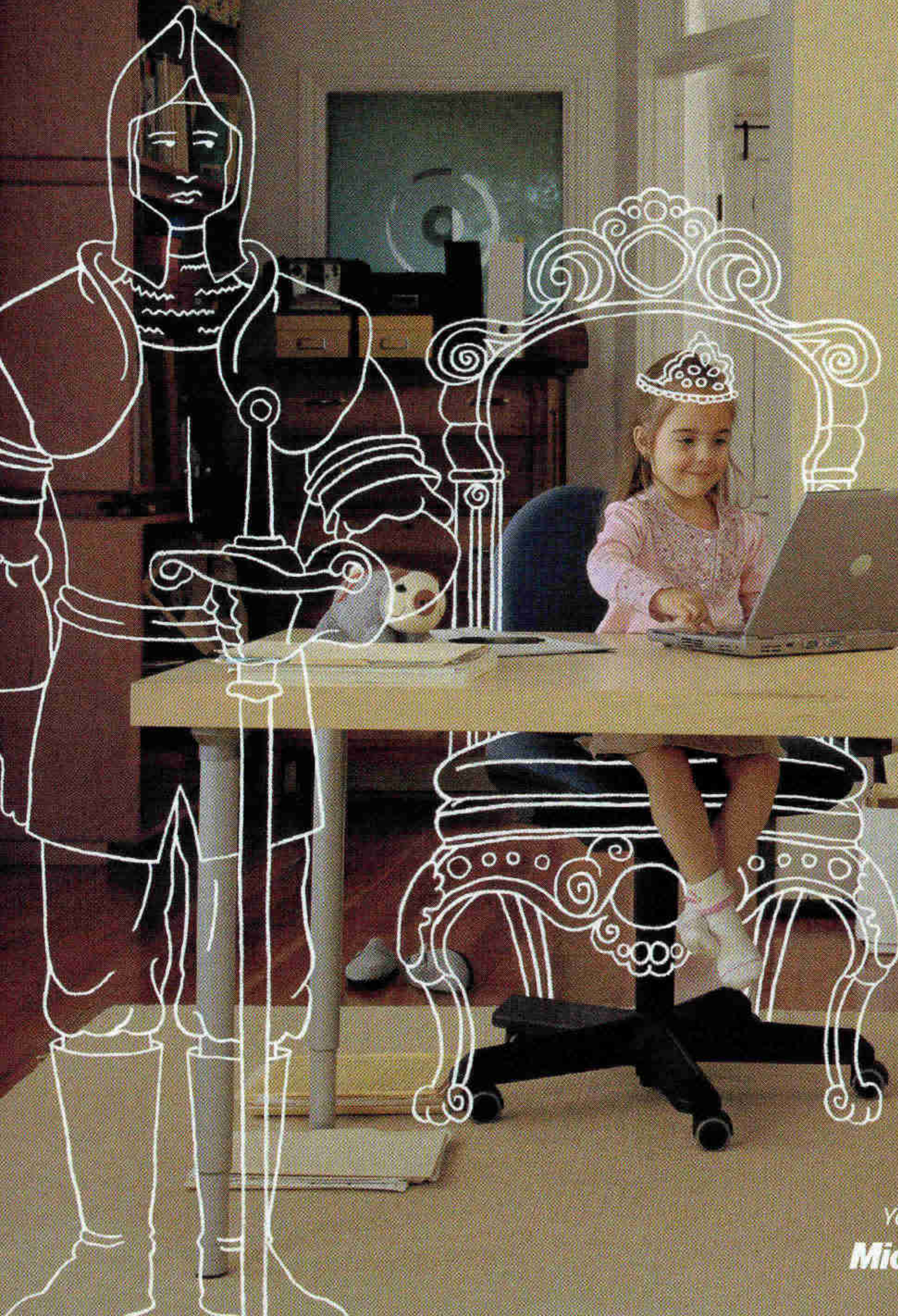
Marine Stewardship Council labels seafood from environmentally responsible fisheries. eng/msc.org

National Audubon Society produces wallet-size fish guides for consumers to take along to restaurants. seafood.audubon.org

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BEHIND THE SCENES Remembering Todd National Geographic lost a great friend last October when Todd Skinner's climbing harness failed as he descended Yosemite's Leaning Tower. He was 47. Skinner revolutionized rock climbing by using gymnastic free-climbing techniques to scale big walls from California's El Capitan to Pakistan's Karakoram Range (above). Famous for his positive, good-hearted, mischievous spirit, he was "one of those people you'd meet for five minutes and never forget," says his friend and agent Ann Krcik. An adviser to the National Geographic Society's Expeditions Council, Skinner leaves behind his wife, Amy, and their three children, Hannah, Jake, and Sarah.



ON ASSIGNMENT
Hip-Hop Blues

At speaking engagements across the U.S. "80 percent of the kids I meet see the music industry as a way to get out" of their present circumstances, says author James McBride (left, at far right). In Senegal the story was the same. Rapper Omar N'Gala Seck, Jally, a traditional griot, and Assane N'Diaye (from left) play their music in hopes of a big break that will help lift their families out of poverty.

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Curiosity gets the best of a wild cub as Dereck Joubert films in a Botswana game reserve for National Geographic Channel.

ON ASSIGNMENT

Leopard Lessons

Explorers-in-Residence Dereck and Beverly Joubert got closer than they expected to the young leopard whose life they were following. Dereck was trying a low-angle shot across a puddle in Botswana's Moremi Game Reserve when the leopard leaped across the water to confront what she took to be an intruder—her own reflection in the camera's lens. "It really got to her," Dereck said. "But she paid no attention to me at all. We'd already spent so much time with her that this *other* leopard cub, the one she saw in the camera, was the new element in her life."

April Contributors

GLOBAL FISH CRISIS, page 32

Brian Skerry's photographs appear in "Still Waters" as well as "Blue Haven." He spent two years documenting the effects of overfishing—and the solutions to the problem.

Randy Olson, whose photos also illustrate "Still Waters," won Magazine Photographer of the Year in 2003, and Newspaper Photographer of the Year in 1992.

Fen Montaigne traveled to Japan and the Mediterranean on assignment for "Still Waters." He is the author of *Reeling in Russia*.

Kennedy Warne was the writer for "Blue Haven." His most recent GEOGRAPHIC story was "Forests of the Sea" for the February 2007 issue.

Chris Carroll, a staff writer, learned from Newfoundland fishermen while reporting "End of the Line" that seasickness is nothing to be ashamed of.

Joachim Ladefoged has won three World Press Photo awards. "End of the Line" is his first project for the GEOGRAPHIC.

HIP-HOP, page 100

James McBride is the author of *The Color of Water*, *Miracle at St. Anna*, and most recently, *Song Yet Sung*, a novel about the Underground Railroad.

David Alan Harvey, a member of the Magnum photographic cooperative, has shot more than 40 stories for NATIONAL GEOGRAPHIC since 1973.

TALLGRASS PRAIRIE, page 120

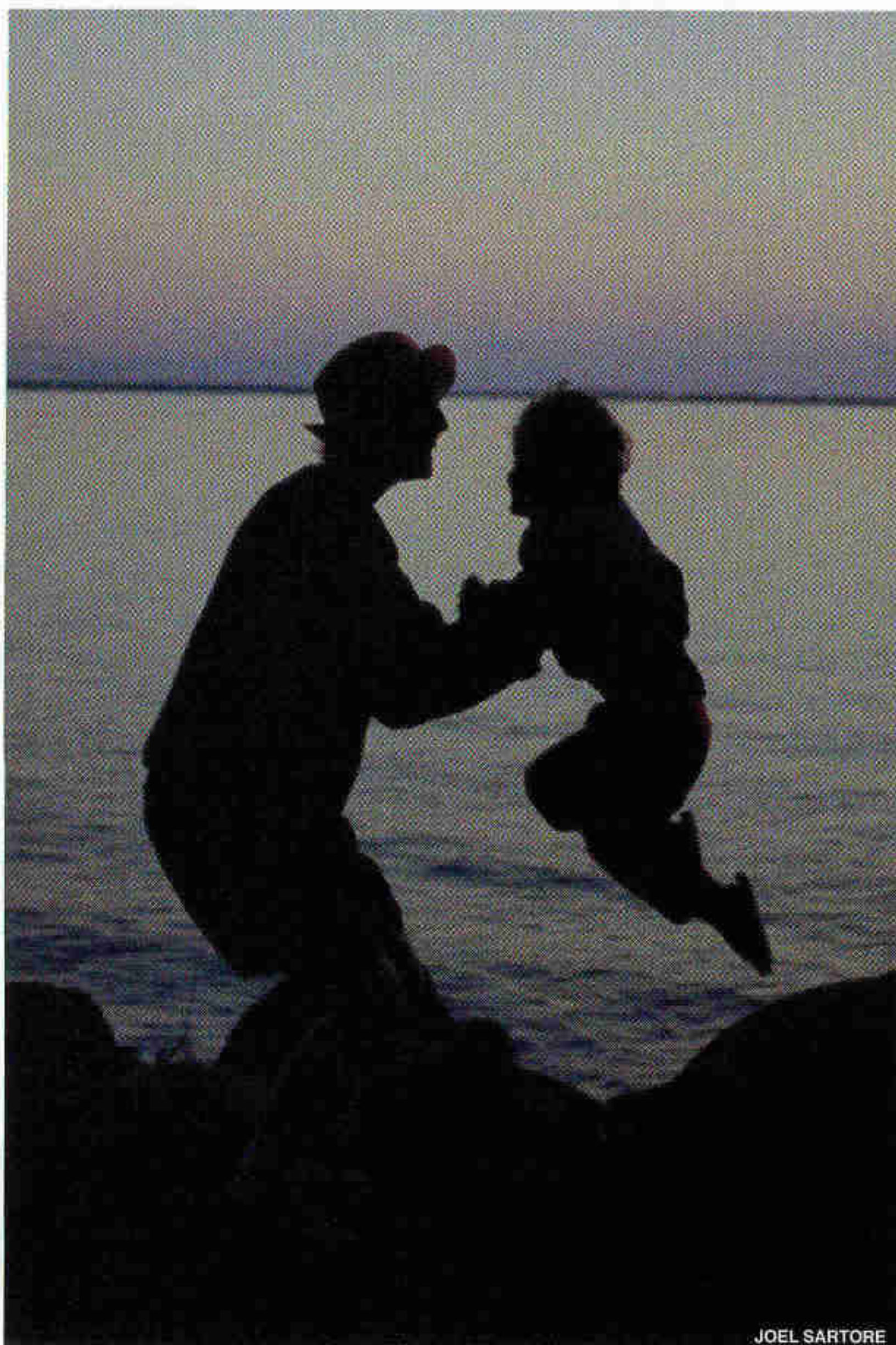
Verlyn Klinkenborg's latest book is *Timothy; or, Notes of an Abject Reptile*, a story about the English countryside as seen through the eyes of an 18th-century tortoise.

Jim Richardson has been photographing his native Kansas for nearly five decades. From his home in Lindsborg, he kept an eye on the summer thunderclouds towering up from the Flint Hills to chase down the pictures for this story.

LEOPARDS, page 142

Beverly and Dereck Joubert specialize in chronicling the lives of wild animals. *The Africa Diaries* is a memoir of their life in the bush.

📌 **Tales From the Field** Learn more about our contributors in Features at ngm.com/0704.



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NG GRANTEE Cleanup Crew Working as a shell diver in the Mississippi River, Chad Pregracke saw tons of trash lining the riverbanks—barrels, tires, cars. At age 22, he founded the nonprofit organization Living Lands & Waters. For the past ten years Pregracke (above) and his crew have been living on a barge cleaning up millions of pounds of trash along the banks of our nation's rivers with help from tens of thousands of volunteers. Pregracke chronicles his adventures in his new memoir *From the Bottom Up*.



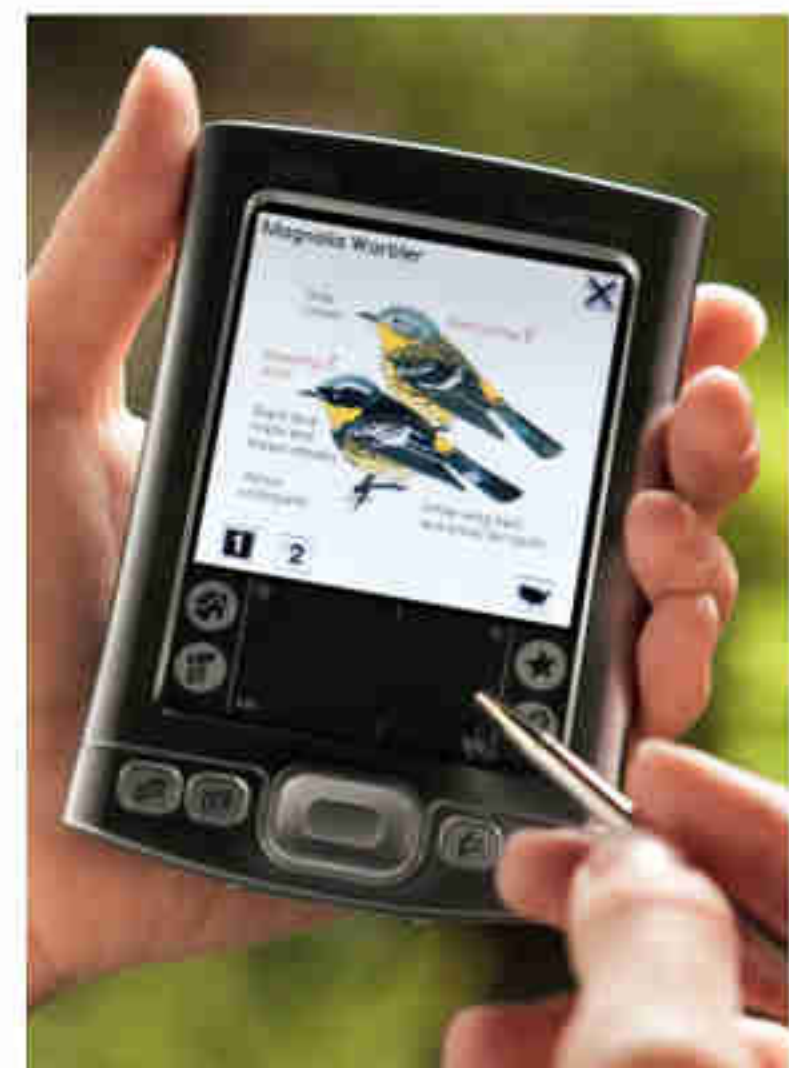
NG FILMS Roar Goes 3-D Deadly drama ensues when a young male lion tries to take over an established pride in the Kalahari Desert. *Roar: Lions of the Kalahari*, an award-winning documentary chronicling the struggle to survive, has been completely remastered in 3-D for large screens. With breathtaking cinematography by Tim Liversedge, *Lions 3D: Roar of the Kalahari* will put you in the middle of the action as the big cats vie for dominance. Now playing at IMAX 3-D and other specialty theaters.

NG Products

Birding Enters the Digital Age

If it looks like a fulvous whistling-duck and quacks like a fulvous whistling-duck, it might actually be a gadwall. Just in time for spring migrations, **National Geographic Handheld Birds**, new birding software for handheld PDAs, lets birders search a database of more than 850 North American birds, using criteria such as name, size, color, or location. With more than 1,600 bird images, 650 range maps, and nearly four hours of birdsongs and calls, it's the perfect digital field guide for expert hobbyists and backyard enthusiasts alike.

Search for "gadwall," and multiple images of the duck species will appear in addition to a trove of information about habitat, voice, foraging, similar species, and more. The eBird checklist lets users log their sightings and, if they like, send them to the Cornell Lab of Ornithology to aid bird conservation. National Geographic Handheld Birds is available as a software card or bundled with the PalmOne Tungsten E2. For more information, visit nationalgeographic.com/handheldbirds.



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Trout à la Luis A man beyond legend, the late Luis Marden, who wrote and photographed for NATIONAL GEOGRAPHIC for 64 years, slipped his passions into every story he touched. Marden, fluent in five languages, a pioneer in underwater photography, discoverer of the remains of the *Bounty*, to list only a few of his accomplishments, found a way to cast a line (usually a fly line) into practically every drop of exotic water he encountered. On assignment in Panama in 1941, he sniffed out a trout stream on the forested slopes of a volcano, caught three rainbows (serendipitously stocked in 1925 by a fellow trout-o-phile), and recorded the moment as a still life. “Fishing,” he once wrote a friend, “is a solace . . . the opposite of war, a civilized, gentle, and healing occupation.” —Cathy Newman

👉 **Flashback Archive** See all the photos plus e-greetings at ngm.com/0704.

PHOTO: LUIS MARDEN, NG IMAGE COLLECTION

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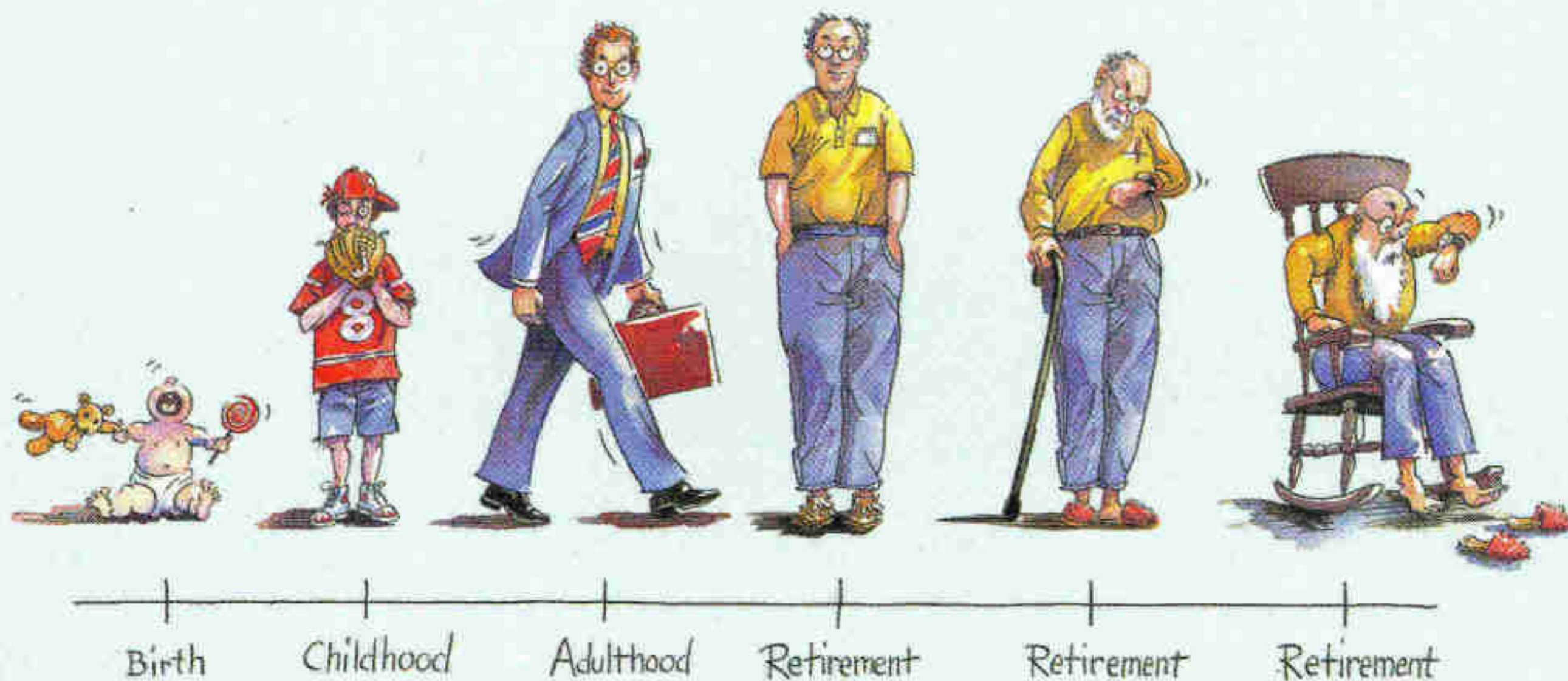


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Average life expectancy in the U.S. has risen to an all-time high. Great news, except that the amount of money people put away for retirement isn't rising at all. How is our nation going to make sure its citizens have the money to retire? Allstate has a few ideas:

1. EXAMINE SOCIAL SECURITY

Americans will not be able to rely solely on Social Security for a comfortable retirement. In the future, it's projected to cover an increasingly smaller percentage of the average retirement. There's debate as to whether it should be repaired or replaced. But what's clear is we need to reform Social Security *now*.

2. BOOST RETIREMENT PLAN ENROLLMENT

Companies should continue looking for ways to encourage employee participation in 401(k) plans. One proven method to increase retirement savings is

through company matches. Another is automatic enrollment—employees are signed up for savings plans when they join the company, unless they specifically opt out.

3. INCREASE PERSONAL SAVINGS

Ultimately, everyone is responsible for their own retirement. It's why we support laws that reward people for saving. Tax-advantaged savings vehicles, like annuities and IRAs, are two examples of products that can help allay Baby Boomers' biggest fear: living to see the well run dry.

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